

ONR BAA 14-009 Amendment 01

The purpose of this amendment is to provide the DD 254 related to the BAA, the industry day briefing slides, the list of questions and answers from the Industry Day as well as questions submitted since the release of the BAA, and to delete sections of the original BAA.

Specifically, the paragraph beginning “It is extremely important....” immediately before “Thrust Area 1” paragraph in section I.F, page 7 is deleted in its entirety.

The paragraph beginning “To facilitate the alignment....” immediately after the paragraph titled “Thrust Area Dependencies in section I.F, page 11 is deleted in its entirety.

Questions received to date and their responses are as follows (similar questions are not repeated):

Question 1: I attended the Industry Day on 24 Jun and it was mentioned that the presentations would be made available via the FedBizOpps or ONR site the following week. Are these presentations available for download as of this time?

Response: The briefing slides are a part of Amendment 01.

Question 2: May we submit SCI level proposals and white papers? If yes, how do we coordinate delivery of these documents?

Response: The classification level allowed is only Secret.

Please refer to NISPOM Section 5-401 and 5-403 for mailing classified information requirements. If you will be using a courier to deliver the classified white papers, please let the security point of contact know ahead of time to ensure someone from ONR Document Control section will be available to receive the package.

Question 3: Period of Performance: The PoP is listed as “Up to five years.” Is there a notional schedule for the program (i.e., Thrust 1, years 1-3, Thrust 2, years 2-4, etc.)?

Response: At this time there is no plan to limit Thrusts to particular subsets of the five year period of performance.

Question 4: Cost Proposal: BAA indicates that awards will be made to offerors who are selected for “Year 1” funding. Does that mean that contractors should prepare a cost proposal to include each year as a separate option, or should options only be used for completely separate and optional features?

Response: Proposers should prepare cost proposals that include a base year with options, if appropriate. Options may also be used for completely separate optional features.

Question 5: Classification: The BAA says “If a classified proposal is submitted, the resultant contract will be unclassified.” Does that mean the literal contract (SOW, SRD, etc.) or the actual work will be unclassified?

Response: It means that the literal contract will be unclassified. Work and deliverables can be conducted at the classified level.

Question 6: Thrust 1 vs. Thrust 2 Discrepancy: Thrust 1 is strongly focused on SemWeb (RDF/OWL) technologies but Thrust 2, which deals with the cloud architecture (NCTRI) in which the data will presumably reside, does not contain any technologies that natively process or store RDF data. Additionally, none of the S&T Challenges for Thrust 2 address processing or storing RDF data. Therefore, if a contractor has ideas relating to the ingestion, processing, storage, and dissemination of SemWeb (RDF/OWL) data, does ONR recommend contractors to propose to Thrust 1 or Thrust 2?

Response: Ideas relating to the ingestion of SemWeb (RDF/OWL) data are best addressed in Thrust 2. Ideas relating to the processing of SemWeb (RDF/OWL) are assumed to be a form of analytic, and therefore best addressed in Thrust 3. Ideas related to storage are not of interest. (Ideas related to Naval data representation are of interest and best addressed in Thrust 1). Finally, ideas related to dissemination of data are of interest if they focus on how data representation and semantic representation can facilitate dissemination, not on underlying dissemination mechanisms (which ONR is addressing separately). In this case, ideas for using data representations and semantic representations that facilitate dissemination should be addressed in Thrust 1.

Question 7: Integration and Experimentation: How many resources or personnel should be allocated to account for LTE (Testing and Transition) activities? The BAA provides little guidance in this area and therefore scope could be enormous.

Response: Limited Technology Experiments (LTE) are typically 4-9 months in duration (depending on scope) and have a battle rhythm that is orchestrated by an independent team, separate from offerors. Selected performers are expected to support weekly phonecons (~60-90 minutes) and depending upon S&T capabilities being developed performers may need to interact with other performers of co-dependent capabilities to resolve interface definition and/or issues that arise. The independent team will include an Experimentation Lead and Chief Engineer to orchestrate the effort, resolve conflict, etc. LTEs typically include integration periods at a government facility that are typically 1-2 months in duration although there are typically many technology articles being integrated so performers are only required on-site for a subset of this time. LTE execution is typically 1-2 weeks in duration depending upon scope and would require support by performers with technology articles featured in the LTE. Thus, resource scoping should include the following:

- a. Weekly phonecon support (and prep if necessary)
- b. Interface activity between co-dependent performers
- c. Integration support
- d. LTE execution support

Question 8: “NTCRI” and “Naval Data Ecosystem Framework” Link and Information Request: Please provide the missing link for the Naval Tactical Cloud Reference Implementation. The BAA provides URLs starting with http://, but the links are incompletely specified.

Response: Amendment 01 to the BAA deletes the references to these URLs.

Question 9: In the BAA the URLs to the Naval Tactical Cloud Reference Implementation and the Naval Data Ecosystem Framework are missing. Are these URLs available?

Response: These references and the associated links have been deleted from the BAA.

Question 10: NTCRI: Does the Naval Tactical Cloud Reference Implementation (NCTRI) exist? Can a contractor get access to its code and/or architecture document?

Response: Yes, the Naval Tactical Cloud Reference Implementation (NCTRI) does exist. Contractors that receive awards under this BAA will get access to code and documentation. Access will not be provided prior to award.

Question 11: Security: What security capabilities currently exist in the NTCRI?

Response: The primary security mechanisms in the NTCRI are the fine grain, cell-level access control mechanisms provided by Accumulo.

Question 12: Please clarify any distinctions between Thrust 1, 2, 3, and 4 with regards to response preparation, funding or schedule: The BAA states: “Any Offeror whose White Paper was not identified as being of “particular value” under Thrusts 1, 2, or 3, to ONR is ineligible to make an oral presentation or to submit a Full Proposal under this BAA.” What about Thrust 4?

Response: The same constraint applies to Thrust 4.

Question 13: Assuming a vendor’s response is selected and moves through the entire process, please advise what form of contract is expected to be awarded.

Response: A cost-type completion contract is expected to be awarded.

Question 14: Paragraph 1 on page 17 states that multiple White Papers may be submitted. If multiple White Papers are submitted, does each need to be sent in a separate email submission or can they be submitted under the cover of one email?

Response: Each White Paper should be submitted individually.

Question 15: We are interested in teaming with other companies having Naval domain expertise. Is it possible to get the list of attendees/companies who attended the ONR industry day?

Response: A list of attendees will not be provided.

Question 16: On FedBizOpps, BAA 14-009 is listed as presolicitation. Will there be a formal release of the solicitation? If there is an update, will additional time be given for the white paper, or is July 18th still the date?

Response: The date that BAA 14-009 was submitted to FEdBizOpps was the release date. No additional time will be given for the white paper due to this amendment.

Advanced Analytics and Data Science for Naval Warfare Planning and Execution

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INTRODUCTION:

This publication constitutes a Broad Agency Announcement (BAA) as contemplated in Federal Acquisition Regulation (FAR) 6.102(d)(2) and 35.016 and the Department of Defense Grants and Agreements Regulations (DoDGARS) 22.315(a). A formal Request for Proposals (RFP), other solicitation, or additional information regarding this announcement will not be issued.

The Office of Naval Research (ONR) will not issue paper copies of this announcement. The ONR reserves the right to fund all, some or none of the proposals received under this BAA. ONR provides no funding for direct reimbursement of proposal development costs. Technical and cost proposals (or any other material) submitted in response to this BAA will not be returned. It is the policy of ONR to treat all proposals as sensitive competitive information and to disclose their contents only for the purposes of evaluation.

I GENERAL INFORMATION:

A. Agency Name - Office of Naval Research

B. Research Opportunity Title - Advanced Analytics and Data Science for Naval Warfare Planning and Execution

C. Program Name - Data Focused Naval Tactical Cloud

D. Research Opportunity Number - 14-009

E. Response Date -

White Papers: 7/18/2014

Full Proposals: 10/3/2014

F. Research Opportunity Description -

Objective.

The Office of Naval Research is interested in receiving white papers and full proposals for Advanced Technology Development that will forge major advancements towards a well developed and robust Naval Big Data Ecosystem that enables more sophisticated and powerful analytics for supporting Naval Warfighting applications. To accomplish this objective, ONR seeks to make advancements in four key Thrust Areas: (1) Development of a robust Naval Data Science foundation that addresses data representations and ontologies required to support a wide range of Naval Warfare Mission Areas; (2) Identifying, acquiring, ingesting, and indexing Data Sources pertinent to Naval Warfighting Missions; (3) Development of advanced analytics for Naval Warfare Mission Areas; and (4) Development of data protection and security mechanisms to ensure the integrity of data used throughout the analytic process. The overall objective of this effort is to achieve unprecedented access to data; to extract new and deeper insights by exploiting data in new and innovative ways; and to apply those new insights to improving Naval Warfare

activities.

Integration of National and Tactical Information.

A major goal of this effort is to significantly improve the Naval community's real-time ability to bring together information from National systems and sensors with information from Naval combat and weapon systems and sensors. In the past, the ability to merge these types of information to support tactical warfighting has been extremely limited. Emerging technologies (such as Cloud, Computing, Big Data, and more effective Cross Domain technologies) are enabling us to overcome many of the technological and infrastructure limitations that limit the ability to integrate and exploit National and tactical data sources. This BAA seeks to leverage the power of these emerging technologies to develop innovative and ground-breaking analytic capabilities that enhance threat assessment and prediction, combat ID, integrated fires, and Naval mission planning and execution. Enhancements to these capabilities will be focused on two Naval Warfare Areas: Anti-Submarine Warfare (ASW) and Integrated Air/Missile Defense (IAMD).

Anti-Submarine Warfare (ASW).

Anti-Submarine Warfare is a critically important warfare area for the Navy. Over the past decade, U.S. adversaries have been making significant investments in their submarine capabilities, making detection, identification, and en-gagement of submarine threats a much more challenging proposition. Furthermore, the large increase in commercial shipping traffic has made submarine detection and identification a much more difficult activity. Conventional methods of relying on organic tactical sensors as the primary means for conducting ASW are no longer sufficient. ONR is interested in developing advanced ASW analytic capabilities that make use of a much broader range of data sources and that cross traditional system boundaries. Some examples of the types of data sources and ASW analytical capabilities that are of interest include (but are not limited to):

- Enemy Course of Action data - example analytic might use historical Pattern of Life data such as depth operating profile, speed profile, noisy evolution schedule, navigational strategies, and historical tracks to portray three-dimensional probability distributions of likely threat position for each of the enemy course of action (ECOAs) being modeled. Contact report data of various precision and confidence will be tested against the modeled ECOAs and the likelihood of each ECOA will be adjusted. The analytic will be expected to work in a multi-threat context and take advantage of class specific identifiers.
- Organic/non-organic combatant sensor data - example analytic might data mine for contact data and below threshold contact follower snippets to cluster information over time that may not be recognized when analyzed in isolation from one another. The analytic will test for consistency, allowing for unique capabilities of disparate sensor types. The analytical will account for bearing and range uncertainties in its kinematic testing of whether or not a single threat submarine could account for the cluster of data. Analytics may explore how filter thresholds (e.g., auto-alert thresholds) might be adjusted to better inspect only that data that would be consistent with the clustered snippets, thus allowing improved recognition while controlling false alarm rate.
- Organic/non-organic environmental data - example analytic might use in-situ acoustic data (e.g., noise measured through the sensor) or oceanographic data (e.g., sound speed profile from any number of sources including XBT data) to monitor differences between expected conditions and encountered conditions. The search plans and sensor line-ups are predicated on acoustic and environmental parameters. The analytic monitors the difference between planned and encountered conditions and evaluates if it is significant. When

a difference is determined to be significant, an alert is generated that a new search plan or line-up plan may be needed. If search plan or line-up plan algorithms are resident in the NTC, a recalculation is spawned and operators are notified of results.

- Blue operational behaviors, characteristics and performance - example analytic might use in-situ platform position, heading, speed, and depth data to monitor platform compliance with the intended search plan. This analytic accommodates different levels of search plan specificity. The analytic monitors the difference between planned and executed search effort and evaluates if it is significant. When a difference is determined to be significant, an alert is generated that a new search plan may be needed. If search plan algorithms are resident in the NTC, a recalculation is spawned and operators are notified of results. Another analytic might monitor ship heading or towed array heading data and calculate the impact of course changes of search effectiveness; an alert may be generated when towed array stability is evaluated as overly compromised.
- National Technical Means (NTM) - example analytic might gather all available NTM data and process it so that it could be brought into a geographic plot of threat probability density. The analytic will be interested in gathering both positive search information and negative search information, which will require information of the NTM sensor footprint and conditions necessary for detection. An analytic may test this NTM data with other sensor data sources.

Proposers are encouraged to show how your proposed efforts would support the achievement of these objectives. Because many of the data sources and analytic methods associated with ASW are classified, ONR encourages Pro-positors to submit classified proposals where necessary to fully convey the proposed effort.

Integrated Air/Missile Defense (IAMD).

Integrated Air/Missile Defense is another Naval Warfare Area that is of critical importance to the Navy. The rapid expansion of anti-ship and ballistic missiles (both in numbers and capabilities) is a major challenge to Navy IAMD capabilities. AEGIS is the Nation's primary ballistic missile defense system, engaging air and ballistic missile threats with a family of Standard Missiles. In the past, AEGIS could be counted on to engage all incoming air and missile threats, but today's expanded missile threats and predicted raid sizes can easily overwhelm the weapon resources of a single ship. Going forward, the Navy must be prepared to use its sensor and weapon resources much more judiciously. It is critical to better characterize missile and air threats in a way that allows for intelligent use of Standard Missile resources (to engage only the most critical threats), as well as to identify air/missile threats that could be mitigated using other methods (e.g., deception, cyber methods, directed energy). ONR is interested in developing advanced IAMD analytic capabilities that make use of a much broader range of data sources and that cross traditional information swim lanes. Some examples of the types of data sources and IAMD analytical capabilities that are of interest include (but are not limited to):

- Improved Identity Classification, Intent and Future Movement Prediction, and Track Association - example analytic might use Identification Friend-or-Foe (IFF)/Automatic Identification System (AIS) data; flight plans, schedules, air routes; intelligence information; collected second and third tier information sources in addition to primary sources; shipping lanes and fishing areas; organic sensor information to recommend the identification of a track, to predict its intent and future movement, and/or recommend its association with another track.

- Optimizing sensor configuration - example analytic might use historical and current environmental data; indications, alerts, and warnings; real-time and historical sensor measurements; real-time operational status of a sensor; sensor models to produce optimal sensor settings recommendations.
- Identifying unexpected Red Air and Missile capabilities, behaviors, and operational patterns - example analytic might use intelligence information; missile models; historical measurements; Intelligence threat library (e.g. Anti-Ship Cruise Missile/Ballistic Missile Radar, Electronic Warfare, and Infrared signatures) data sets; live sensor data; Electronic Warfare/Non-cooperative target recognition data to identify new capabilities, behaviors, and operational patterns and possibly recommend new systems settings to address them.
- Improved planning of asset movement and tactical utilization - example analytic might use models and simulations; readiness information; plans; doctrine; predicted Red/White/Blue future movement; Intelligence data; historical and current weather conditions to recommend how to move assets so that tactical assets can be optimally utilized.
- Weapons usage optimization - example analytic might utilize threat disposition; current inventory levels across the battle group; knowledge of planned and active engagements and results; weapons models to recommend optimal utilization of weapons across the battlegroup/force and strategies for coordinated fires.
- Improved spectrum operations - an example analytic might use plans; historical usage patterns; offender/victim performance parameters; Order-of-Battle/Electronic Order-of-Battle; Intelligence information; organic measurements; earth and space weather measurements and predictions to recommend an optimum spectrum allocation for the battlegroup/force, to identify interference, to support planning for future operations and changing environmental conditions.
- Improved situational awareness - an example analytic might use indications and warnings; current, predicted, and historical movements of Red/White/Blue assets; Intelligence sources to identify information that should trigger a warfighter notification (e.g. an alert).
- Cyber awareness - an example analytic might use data from organic and non-organic cyber sensors to assess the state of visible cyberspace and to identify patterns indicative of anomalous activity.

Proposers are encouraged to show how your proposed efforts would help support the achievement of these objectives. Because many of the data sources and analytic methods associated with IAMD are classified, ONR encourages Proposers to submit classified proposals where necessary to fully convey the proposed effort.

Cross Warfare Areas.

In addition to the ASW and IAMD Naval Warfare areas, ONR is interested in capabilities of a cross cutting nature. Since most Naval platforms are designed to support multiple Warfare areas, it is often the case that optimizing the battlegroup/force for one Warfare area comes at the expense of other Warfare areas. ONR is also interested in ana-lytics and applications that address battlegroup/force level operations that span multiple Warfare areas. Cross Warfare area proposals, need not be limited to ASW and IAMD. Other Warfare areas that will be accepted include Anti-Surface Warfare (ASuW), EW, Mine Warfare (MW), and

Strike Warfare. However, greater weight will be given to Cross Warfare area proposals that include either ASW or IAMD.

The Naval Tactical Cloud Reference Implementation.

Over the past several years, ONR has developed a Big Data Ecosystem software platform called the Naval Tactical Cloud Reference Implementation (NTCRI) that provides an environment for storing relevant Naval Data sources and for hosting and executing advanced Naval analytics and applications. The intent of this BAA is to leverage the NTCRI as the underlying environment for all work performed under this BAA. This will allow the full resources of this BAA to be focused on Naval Data Science, analytics, and applications, and not on the development and underlying Big Data and Cloud infrastructure. It is important for proposers to understand that this BAA seeks to develop Naval Data Science and analytics, not to develop infrastructure, systems, tools, or middle-ware. Proposers shall ensure that any proposed work under this BAA not come packaged within unique or proprietary platforms or systems.

Thrust Area #1. Naval Data Science Foundation.

The ability of Big Data to bring together and operate on large numbers of diverse data sets has made it more important than ever to develop common frameworks for characterizing data and achieving understanding of the data across diverse communities. In the past, data representations and ontologies have been developed for individual systems and communities. As we move to an integrated Big Data environment, it becomes important to develop data representations and ontologies that cut across these communities. As part of this BAA, ONR seeks to establish a strong Naval Data Science foundation that develops the data representations and ontologies that will support analytic development across the full range of Naval Warfare activities. ONR is interested in developing data representations and ontologies that address the highly integrated and interdependent nature of modern Naval Warfare. Experience developing real data representations and ontologies is critical for this Thrust Area, as this Thrust Area is focused on data representation and ontology development, not on developing data representation and ontology infrastructure and tools.

To maximize the use of commercially developed tools and services, ONR expects all data representation and ontology efforts to be done in accordance with World Wide Web Consortium (W3C) compliant Resource Description Framework (RDF) for data representation and Web Ontology Language (OWL) for ontologies. To avoid past problems of attempting to develop a universal data representation and ontology, ONR seeks solutions that bring together and connect multiple data representations and ontologies from across many different communities and disciplines. Furthermore, because speed to fielding capability is critically important, the methodologies for developing, implementing, and cross-connecting data representations and ontologies are just as important as the resulting data representations and ontologies. Proposals for this Thrust Area shall speak to the methodologies and solutions that will be employed to enable rapid development, implementation, and alignment of data representations and ontologies, not just the data representations and ontologies that will be delivered. (Note that methodologies refer to patterns and practices, not to specific tools, systems, or software platforms).

In the past, efforts to develop all encompassing data representations and ontologies have met with significant failures. In many cases, this has been because of attempts to develop a monolithic, global solution that takes too long to develop and is not accepted by the various stakeholder communities. To avoid these problems, ONR is interested in developing small, self-contained data representations and ontologies that can be cross-connected and linked, as needed, to form larger, more complex data representations and ontologies. ONR sees this approach as more agile and flexible, better suited to leverage the work of other

communities, and more conducive to support continual evolution.

Proposals in this Thrust Area shall speak to the proposer's ideas and experience in developing federated data representations and ontologies.

For this effort, ONR seeks proposals that will leverage data models and ontologies that have already been developed by various communities. It will be important to demonstrate a good understanding of current data representations and ontologies that already exist, and to address how they can be leveraged. Wherever possible, the use of existing data representations and ontologies from industry and/or from other government and DoD is highly desirable. Examples of such existing data representations and ontologies include

- Common Data Model (CDM) - from the Navy's Product Line Architecture (PLA).
- Track Data Model (TDM) - also from the Navy's PLA
- ASW Community-of-Interest Data Model (ACDM)
- Ontology for Geography Markup Language (OGC)

To fully support the diverse needs of Naval Warfare, it is necessary to represent and model information across a wide range of supporting disciplines. ONR is interested in data representation and ontology solutions that address and account for the following areas: Combat ID, Spectrum Management, Cyber, Blue and Red Force Readiness, Blue and Red Force Structure and Capabilities, Plans & Tasks, Meteorological, and Environment.

The S&T Challenges for this Thrust Area are as follows:

- How can we speed up the creation of data representation and ontology designs from taking years to taking weeks or months?
- How do we avoid the proliferation of too many specialized data representations and ontologies such that it becomes too hard to manage them and integrate them?
- How can we automate the capture and ingestion of legacy data representations and ontologies into the RDF/OWL framework?
- How can we automate the cross-connection of different data representations and ontologies from across diverse communities?
- What are the key data representations and ontology constructs for addressing Cross Warfare Area planning and resource allocation activities?

Those selected to work this Thrust Area will be expected to evolve the data representations and ontologies that are being developed to support the needs of other Thrust Areas. Proposals shall therefore not presume specific answers to what is the right data representation and ontology for a specific area, but shall show how the methodologies and solutions that are proposed can be flexible and adaptable to evolving needs.

Thrust Area #2. Naval Data Source Ingestion and Indexing.

In order to enable the development of advanced Naval Warfighting analytics, it is essential to acquire and make available large data storage that covers the full range of data relevant to ASW and IAMD. The purpose of work under this Thrust Area is to (1) build a rich set of data within the Naval Tactical Cloud Big Data environment that will support the development of advanced analytics for ASW and IAMD and (2) develop enhancements and aug-mentations to the current Naval Tactical Cloud that facilitate faster and easier data ingest and indexing.

Proposers for this Thrust Area shall demonstrate that they have skills, resources, experience, plan, strategy

to monitor and correct the plan and one of the areas reviewers will focus on is computer science; another will be their capabilities with data. The goal is to focus on data ingest and indexing, not on educating a technical team as to what these data sources are and how they are used. Successful proposals in this area will require clear demonstration of data domain expertise in the areas that are proposed.

The ability to ingest and index such a large range of data sets requires the development of highly agile and effective tools and processes for capturing the data. The current Naval Tactical Cloud environment comes with a set of tools and processes for facilitating data ingest and subsequent data indexing. However, the current state of these tools and processes requires Data Scientists to have a deep understanding of the Naval Tactical Cloud's underlying Hadoop/Accumulo environment, and as a result, Data ingest and indexing activities can be highly complex, take significant amounts of time, and require special talent. ONR is interested in software tools and/or methodologies that Proposers can put forward that will help improve the current state of the practice for data ingest and indexing.

Primary interest is leveraging existing tools and methodologies, not developing tools and processes as part of this BAA. However, exceptional ideas for the development of such tools and processes will be considered if (1) they offer a compelling improvement over the current state of the practice and (2) they are considered highly cost effective.

The S&T Challenges for this Thrust Area are as follows:

- How can we improve the speed and accuracy of data ingest?
- How can we simplify the data ingest process to allow people without specialized knowledge of Hadoop/Accumulo to take on the data ingestion role.
- How do we establish and maintain a sufficiently comprehensive and up to date integrated Big Data store to fully support the needs of ASW and IAMD analytic development?
- What are the best ways to index the Naval Data Sources to effectively support ASW and IAMD analytics?
- To what extent can we automate data indexing to improve the speed at which effective indexes can be generated?
- How do we balance the need for extensive and rich indexes with the limitations of storage onboard ships, especially for smaller platforms such as submarines and destroyers?

Those Proposers selected to work this Thrust Area will be expected to adjust their data ingesting and indexing to support the needs of analytic developers working in Thrust Area #3. Proposals shall therefore account for some degree of flexibility as to the range and scope of the data that is put forward as part of your proposal.

Thrust Area #3. Naval Warfighting Analytics.

The central thesis behind Big Data is that great insights can be obtained from large diverse data sets if properly exploited with the right analytics. As ASW and IAMD threats become more capable and more numerous, the development of more powerful analytics is one of the few avenues available to the U.S. Navy to overcome these challenges. The objective of Thrust Area #3 is to develop and evaluate advanced analytics for supporting Naval Warfighting activities, particularly for ASW and IAMD. ONR is seeking highly innovative concepts for analytics that will make significant improvements to these Naval Warfighting areas. All analytics developed under this effort will be expected to run in the Naval Tactical Cloud analytic environment. The Naval Tactical Cloud provides a batch analytic platform (MapReduce) and a streaming analytic platform (STORM). It is important that proposed analytic efforts be compatible with one of these elements of the Naval Tactical Cloud. Proposed analytic efforts that are incompatible with the Naval

Tactical Cloud analytic environment will not be considered.

Proposals for this Thrust Area shall include the following information for each proposed analytic effort: (1) A description of what the analytic is intended to accomplish; (2) What Warfare Area the analytic is intended to support (if applicable to more than one Warfare Area, please indicate); (3) Whether the analytic is a batch or streaming analytic; (4) The rationale for why the analytic will result in significant improvements to the stated Warfare Areas; (5) The data sources required for the analytic; and (6) An assessment of the computational complexity of the analytic.

ONR places no constraints on the type of analytic proposed or the data required to support the analytic (so long as it is reasonable that the data in question can be obtained in real world situations). However, greater weight will be given to analytics that (1) make more extensive use of cross-community data sources and (2) offer the most compelling case for significantly improving ASW and IAMD Warfighting performance.

Some specific examples of analytic areas of interest include:

- Improving Combat ID of submarines, ships, aircraft, and missiles, by analytics that combine data from National sensors, tactical sensors, and Combat Systems.
- Creating more accurate atmospheric and oceanographic forecasts by combining traditional METOC sensors and predictions with data collected by tactical sensors and combat systems.
- Improving the prediction of enemy operations and plans using analytics that exploit historical patterns of life combined with real-time sensor data of enemy movements and actions.

The S&T Challenges for this Thrust Area are as follows:

- How to effectively integrate data across traditionally separate communities (e.g., Intelligence, C2, and Combat Systems)?
- Developing advanced analytics that significantly improve detection and identification of ASW and IAMD threats.
- Developing advanced analytics that significantly reduce the time required to detect, identify, and engage ASW and IAMD threats.
- Developing advanced analytics that significantly increase the effective range and performance of ASW and IAMD platforms and sensors.
- Developing advanced analytics that predict enemy behavior including confidence factor.
- Control False Identification.

Those Proposers selected to work this Thrust Area will be expected to feed their analytics with data from the Big Data store developed in Thrust Area #2.

Proposals shall therefore account for some degree of flexibility as to the range and scope of the data that will be used to support your proposed analytic efforts.

Thrust Area #4. Data Cloud Security and Integrity.

The migration to the NTC environment provides an opportunity to give the warfighter the flexibility to fight through an adversary's attempts to use cyber to degrade or deny the decision making capabilities of naval commanders. Greater cyber maneuverability can be achieved through increased diversity, agility, non-persistent systems, controlled access/centralization, etc. For example, machine virtualization offers a means of decoupling software from a specific hardware implementation. It is now possible to use a commodity hardware model with different hard-ware/software instantiations deployed across the fleet, or even on a ship, at any given time. For an adversary to have a decisive advantage, they need to be able to compromise an

operationally significant number of these instantiations. Similarly, rapidly swapping out hardware components, changing hypervisors or switching to new (or reverting to old) virtualized instantiations of an application potentially negate the significant amount of time / resources expended by an adversary to attack a single hardware or software component. Finally, virtual machines are non-persistent and, when re-started, can be returned to their original trusted state to resolve technical problems as well as minimize time that malware has a foothold in the system. These are examples illustrate how virtualization enables greater cyber maneuverability through diversity and agility

The S&T Challenges for this Thrust Area are as follows:

- Adapt/improve technologies and techniques to protect the NTC by identifying, isolating, and/or removing adversary cyber actors from this infrastructure.
- Develop analogous capabilities or new approaches for the Naval Big Data Ecosystem to assure the integrity and accuracy of the underlying data (which consists of many different types / formats) used to make decisions. These approaches shall provide the capability to understand the provenance of a piece of data (i.e. who created it, what was the process used to create it, who has touched or modified it over its life cycle), to validate or estimate the trust-worthiness of that data and if possible determine the likelihood that a piece of data has been tampered with. If it has been determined that a piece of data has been tampered with, the framework shall assist in finding other data elements that may have been tampered with and ultimately provide the ability to restore the tampered data to a known good state.
- Integrate these capabilities into advanced cyber analytics / applications that leverage the NTC analytic environment while being simple enough for a sailor to operate.

Thrust Area Dependencies.

Work in the first three Thrust Areas will be addressed separately but are not to be viewed in isolation. It is essential that the solutions in each Thrust Area function in a supportive manner. It is essential that data representations and ontologies developed under Thrust Area 1 support the needs of the other Thrust Areas and it is essential that the Data Sources developed under Thrust Area 2 support the advanced analytics developed under Thrust Area 3. ONR will assume responsibility and management to achieve inter-thrust area coordination of awardee activity if necessary.

Integration and Experimentation.

ONR intends all capabilities developed under this BAA to be integrated into the Naval Tactical Cloud Reference Implementation and undergo extensive experimentation to assess performance and operational effectiveness. To ensure successful integration, ONR will make available to all awardees or offerors a Naval Tactical Cloud Reference Implementation developer package (provided as a set of Virtual Machines). Performers will be expected to use the NTC RI developer environment to support Data Science and analytic development and integration activities. Performers will also be expected to bring capabilities developed under this BAA into ONR's Limited Technical Experimentation (LTE) activities. LTEs are multi-performer events where the Data Science and analytic capabilities of multiple performers will be integrated and then evaluated in an operationally relevant environment. Performers will be expected to provide support for integrating their capabilities into the experiment and with the capabilities of other Performers. Performers will also be expected to provide additional technical support to facilitate the set up and execution of the LTEs, including planning for the experiment, set up and initialization of the experiment (including instrumentation of the Performer's software deliverable if needed), execution of the experiment, and data collection during the experiment. ONR will provide a separate analysis team to independently assess the experimental articles and results. However, Performers will be expected to support the analysis team by

responding to inquiries and pre-paring white papers on patterns and practices. All Proposers shall include resources and personnel as part of your Proposal to account for these LTE related activities.

Technology Transition.

ONR desires that S&T products that result from this BAA be capable of, and ready for, integration into yearly technology experiments involving Navy and/or Marine Corps systems. Where possible, products shall use common standards, open architectures, and be extensible for technology advances. ONR expects all work performed under this BAA, including the development of data representations, ontologies, analytics, and data security mechanisms to be made available to the Government with full Government Purpose Data Rights. Innovative Science and Technology (S&T) that supports these goals will be seriously considered and if selected, ONR will provide assistance in technology transition.

Work funded under a BAA may include basic research, applied research and some advanced technology development (ATD). With regard to any restrictions on the conduct or outcome of work funded under this BAA, ONR will follow the guidance on and definition of "contracted fundamental research" as provided in the Under Secretary of Defense (Acquisition, Technology and Logistics) Memorandum of 24 May 2010. As defined therein the definition of "contracted fundamental research", in a DoD contractual context, includes [research performed under] grants and contracts that are (a) funded by Research, Development, Test, and Evaluation Budget Activity 1 (Basic Research), whether performed by universities or industry or (b) funded by Budget Activity 2 (Applied Research) and performed on campus at a university. The research shall not be considered fundamental in those rare and exceptional circumstances where the applied research effort presents a high likelihood of disclosing performance characteristics of military systems or manufacturing technologies that are unique and critical to defense, and where agreement on restrictions have been recorded in the contract or grant.

Pursuant to DoD policy, research performed under grants and contracts that are a) funded by Budget Category 6.2 (Applied Research) and NOT performed on-campus at a university or b) funded by Budget Category 6.3 (Advanced Research) does not meet the definition of "contracted fundamental research." In conformance with the USD(AT&L) guidance and National Security Decision Direction 189, ONR will place no restriction on the conduct or reporting of unclassified "contracted fundamental research," except as otherwise required by statute, regulation or Executive Order. For certain research projects, it may be possible that although the research being performed by the prime contractor is restricted research, a subcontractor may be conducting "contracted fundamental research." In those cases, it is the ***prime contractor's responsibility*** in the proposal to identify and describe the subcontracted unclassified research and include a statement confirming that the work has been scoped, negotiated, and determined to be fundamental research according to the prime contractor and research performer.

Normally, fundamental research is awarded under grants with universities and under contracts with industry. ATD is normally awarded under contracts and may require restrictions during the conduct of the research and DoD pre-publication review of research results due to subject matter sensitivity.

FAR Part 35 restricts the use of the Broad Agency Announcements (BAAs), such as this, to the acquisition of basic and applied research and that portion of advanced technology development not related to the development of a specific system or hardware procurement. Contracts and grants and other assistance agreements made under BAAs are for scientific study and experimentation directed towards advancing the

state of the art and increasing knowledge or understanding.

As regards to the present BAA, the Research and Development efforts to be funded will consist of applied research and advanced technology development. The funds available to support awards are Budget Activity 2 and 3.

THIS ANNOUNCEMENT IS NOT FOR THE ACQUISITION OF TECHNICAL, ENGINEERING AND OTHER TYPES OF SUPPORT SERVICES.

G. Point(s) of Contact -

Questions of a technical nature should be submitted to:

Program Manager Name: Dr. Carey Schwartz
Address: 875 North Randolph Street, Arlington, VA, 22203
Code: 311
Phone: 703.696.7824
Email: carey.schwartz@navy.mil

Questions of a Business nature, and suggestions for improvement, should be submitted to:

Name: Lynnette Desorcie
Address: 875 North Randolph Street, Arlington, VA, 22203
Code: BD252
Phone: 703.696.4324
Email: lynnette.desorcie@navy.mil

Any questions regarding this solicitation must be provided to the Technical Point of Contact and Business Point of Contact listed in this solicitation. All questions shall be submitted in writing by electronic mail.

Comments or questions submitted shall be concise and to the point, eliminating any unnecessary verbiage. In addition, the relevant part and paragraph of the Broad Agency Announcement (BAA) shall be referenced.

Questions submitted within 2 weeks prior to a deadline may not be answered, and the due date for submission of the white paper and/or full proposal will not be extended.

Amendments will be posted to one or more of the following webpages:

- Federal Business Opportunities (FEDBIZOPPS) Webpage - <https://www.fbo.gov/>
- Grants.gov Webpage - <http://www.grants.gov/>
- ONR Broad Agency Announcement (BAA) Webpage - <http://www.onr.navy.mil/en/Contracts-Grants/Funding-Opportunities/Broad-Agency-Announcements.aspx>

Questions of a security nature shall be submitted to:

Diana Pacheco

Industrial Security Specialist
Office of Naval Research
Security Department, Code 43
One Liberty Center
875 N. Randolph Street
Arlington, VA 22203-1995
Email Address: diana.pacheco@navy.mil

Note: All UNCLASSIFIED communications shall be submitted via e-mail to the Technical Point of Contract (POC) with a copy to the designated Business POC.

CLASSIFIED questions shall be handled through the ONR Security POC. Specifically, any entity wanting to ask a CLASSIFIED question shall send an email to the ONR Security POC with copy to both the Technical POC and the Business POC stating that the entity would like to ask a CLASSIFIED question. DO NOT EMAIL ANY CLASSIFIED QUESTIONS. The Security POC will contact the entity and arrange for the CLASSIFIED question to be asked through a secure method of communication.

H. Instrument Type(s) - Contracts and Grants

Awards may take the form of Contracts and Grants as appropriate. ONR reserves the right to award a different instrument type if deemed to be in the best interest of the Government.

Any contract awards resulting from this BAA will incorporate the most current FAR, DFARs, NMCARS and ONR clauses.

Examples of model contracts can be found on the ONR website at the following link:
<http://www.onr.navy.mil/Contracts-Grants/submit-proposal/contracts-proposal/contract-model-awards.aspx>.
ONR Contract specific representations and certifications can be accessed on the following page of the ONR website: <http://www.onr.navy.mil/Contracts-Grants/Funding-Opportunities/Requests-for-Information.aspx>.

Examples of model grants can be found on the ONR website at the following link:
<http://www.onr.navy.mil/en/Contracts-Grants/submit-proposal/grants-proposal/model-grant.aspx>.

I. Catalog of Federal Domestic Assistance (CFDA) Numbers -

12.300

J. Catalog of Federal Domestic Assistance (CFDA) Titles -

Basic & Applied Scientific Research

K. Other Information -

II. AWARD INFORMATION

A. Amount and Period of Performance- Estimated Total Amount of Funding Available (\$K):

FY2015	FY2016	FY2017	FY2018	FY2019	Total
\$3750	\$4750	\$8500	\$4750	\$6750	\$28500

Anticipated Number of Awards: One or more awards per Topic, as described in the Research Opportunity Description. An Offeror may propose on more than one Topic.

Anticipated Range of Individual Award Amounts: As required to complete each Topic. There may be more than one performer per Topic.

Anticipated Period of Performance: Up to five (5) years

B. Production and Testing of Prototypes-

In the case of funded proposals for the production and testing of prototypes, ONR may during the contract period add a contract line item or contract option for the provision of advanced component development or for the delivery of additional prototype units. However, such a contract addition shall be subject to the limitations contained in Section 819 of the National Defense Authorization Act for Fiscal Year 2010.

III. ELIGIBILITY INFORMATION

All responsible sources from academia and industry may submit proposals under this BAA. Inclusive of Small Business Concerns, Historically Underutilized Business Zone (HUBZone) Concerns, Service-Disabled Veteran-Owned Small Business (SDVOSB) Concerns, Small Disadvantaged Business (SDB) Concerns, Women-Owned Small Business (WOSB) Concerns, Veteran-Owned Small Business (VOSB) Concerns, and Historically Black Colleges and Universities (HBCUs) and Minority Institutions (MIs) are all highly encouraged to submit proposals as prime contractors and as well as join others (e.g., subcontractors) in submitting proposals. However, no portion of this BAA will be set-aside for Small Businesses, HUBZones, SDVOSBs, SDBs, WOSBs, VOSBs or HBCU and MI participation, due to the desire to seek research ideas from all entities.

Federally Funded Research & Development Centers (FFRDCs), including Department of Energy National Laboratories, are not eligible to receive awards under this BAA. However, teaming arrangements between FFRDCs and eligible principal bidders are allowed so long as they are permitted under the sponsoring agreement between the Government and the specific FFRDC.

Navy laboratories and warfare centers as well as other Department of Defense and civilian agency laboratories are also not eligible to receive awards under this BAA and should not directly submit either white papers or full proposals in response to this BAA. If any such organization is interested in one or more of the programs described herein, the organization should contact an appropriate ONR POC to discuss its area of interest. The various scientific divisions of ONR are identified at <http://www.onr.navy.mil/>. As with FFRDCs, these types of federal organizations may team with other responsible sources from academia and industry that are submitting proposals under this BAA.

University Affiliated Research Centers (UARC) are eligible to submit proposals under this BAA unless

precluded from doing so by their Department of Defense UARC contracts.

Teams are also encouraged and may submit proposals in any and all areas. However, Offerors must be willing to cooperate and exchange software, data and other information in an integrated program with other contractors, as well as with system integrators, selected by ONR.

Some topics cover export controlled technologies. Research in these areas is limited to "U.S. persons" as defined in the International Traffic in Arms Regulations (ITAR) - 22 CFR § 1201.1 et seq.

There is no requirement for cost sharing.

IV. APPLICATION AND SUBMISSION INFORMATION

A. Application and Submission Process - Industry Day, White Paper, Oral Presentation, Full Proposals

INDUSTRY DAY: An Industry Day will be conducted at the unclassified level for potential Offerors on Tuesday, 24 June 2014 in Arlington VA. The purpose of the meeting will be to provide potential Offerors with a better understanding of the scope of the Data Focused Naval Tactical Cloud program and objectives of this BAA. The briefing will be held at 9:00 AM Eastern Standard Time (EST) with check-in beginning at 8:00 AM (EST). All attendees are required to pre-register at <https://www.onlineregistrationcenter.com/register.asp?m=4269&c=16> by 3:00 pm on Monday 16 Jun 2014. Pre-registration is mandatory; **WALK-IN REGISTRATION WILL NOT BE PERMITTED**. If requested attendance exceeds capacity, it may be necessary to limit attendance, and organizations will be so notified. ONR will reply via email on or Wednesday, 18 Jun 2014 to confirm attendance of registrants. Those not able to attend this briefing should consult the web page <http://www.onr.navy.mil/XXXX> after Tuesday, 01 July 2014 to see briefing slides and answers to questions submitted during the conference.

WHITE PAPERS: The due date for White Papers is no later than 3:00 PM (EST) on Friday, 18 July 2014. White Papers shall be submitted as an Adobe PDF or Word 2007 file via an e-mail to Dr. Carey Schwartz at carey.schwartz@navy.mil. The subject line of the email must state "BAA 14-009". The body of the email must include the primary point of contact's name, any additional points of contacts (names), title(s), organization, department(s) or company division(s), telephone and fax numbers, and email address(es). Each white paper shall state that it is submitted in response to BAA Number 14- 009 and cite the particular Thrust of the Research Opportunity Description that the White Paper is primarily addressing, 1,2,3, or 4. A White Paper may address only a single Thrust Area, and an Offeror may submit multiple White Papers.

WHITE PAPER EVALUATION/NOTIFICATION: Navy evaluations of the white papers will be issued via email notification on or about Friday, 15 Aug 2014. An expanded oral presentation will be subsequently requested from those Offerors whose proposed technologies have been identified as being of "particular value" to the Navy. However, any such request does not assure a subsequent award. Any Offeror whose white paper technology was not identified as being of "particular value" to the Navy is ineligible to make an oral presentation or to submit a full proposal under this BAA.

ORAL PRESENTATION: ONR will request that Project Managers (PMs)/Principal Investigators (PIs) provide an expanded oral presentation from those Offerors whose proposed technologies have been identified as being of "particular value" to ONR. The purpose of the oral presentation is to provide greater detail than can be contained in the White Paper and to permit the evaluation panel to ask questions to better understand particular aspects of the proposed effort. However, any such request does not assure a

subsequent award. Any Offeror whose White Paper was not identified as being of "particular value" under Thrusts 1, 2, or 3, to ONR is ineligible to make an oral presentation or to submit a Full Proposal under this BAA . The time, location, and briefing format of the oral presentations, if requested, will be provided at a later date via email notification. ONR evaluations of the oral presentations will be issued via email notification on or about Thursday, 18 September 2014.

FULL PROPOSAL: A Full Proposal will be subsequently requested from those Offerors whose proposed technologies have been identified through the aforementioned email as still being of "particular value" to ONR. Any Offeror whose oral presentation for Thrust Areas 1, 2, or 3 was not identified as being of "particular value" to ONR is ineligible to submit a Full Proposal under this BAA. The due date for receipt of Full Proposals is 3:00 PM Eastern Daylight Time (EDT) on Tuesday, 3 October 2014. ONR will select the efforts to be funded for FY15 start-up based upon the evaluation criteria. It is anticipated that final selections will be made within three (3) weeks after Full Proposal submission. As soon as the final Full Proposal evaluation process is completed, PI's will be notified via email of their project's selection or non-selection for FY15 funding. Full Proposals received after the published due date and time will not be considered for funding in FY15. Full Proposals exceeding the page limit may not be evaluated.

B. Content and Format of White Papers/Full Proposals -

White Papers and Full Proposals submitted under the BAA are expected to be unclassified ; however, confidential/classified responses are permitted. If a classified proposal is submitted, the resultant contract will be unclassified. .

Unclassified Proposal Instructions:

Unclassified White Papers and Full Proposals shall be submitted in accordance with Section IV. Application and Submission Information.

Classified Proposal Instructions:

Classified White Papers and Full Proposals shall be submitted directly to the attention of ONR's Document Control Unit at the following address:

OUTSIDE ENVELOPE (no classification marking):

Office of Naval Research
Document Control Unit
ONR Code 43
875 North Randolph Street
Arlington, VA 22203-1995

The inner wrapper of the classified proposal shall be addressed to the attention of Schwartz, Carey (carey.schwartz@navy.mil), ONR Code 311 and marked in the following manner:

INNER ENVELOPE (stamped with the overall classification of the material)
Program: Advanced Analytics and Data Science for Naval Warfare Planning and Execution
Office of Naval Research

Attn: Schwartz, Carey
ONR Code: 311
875 North Randolph Street
Arlington, VA 22203-1995

An 'unclassified' Statement of Work (SOW) must accompany any classified proposal.

Proposal submissions will be protected from unauthorized disclosure in accordance with FAR Subpart 15.207, applicable law, and DoD/DoN regulations. Offerors are expected to appropriately mark each page of their submission that contains proprietary information.

STATEMENT OF WORK

An 'unclassified' SOW must accompany any classified proposal.

For both classified and unclassified proposals, a non-proprietary version of the SOW must also be submitted

IMPORTANT NOTE: Titles given to the White Papers/Full Proposals shall be descriptive of the work they cover and not be merely a copy of the title of this solicitation.

a. WHITE PAPERS

White Paper Format

- Paper Size - 8.5 x 11 inch paper
- Margins - 1 inch
- Spacing - single spaced
- Font - Times New Roman, 12 point
- Max. Number of Pages permitted: 5 pages (excluding cover page, resumes, bibliographies, and table of contents)
- Copies - One (1) electronic copy in Adobe PDF or Word 2007 delivered via email. Electronic (email) submissions shall be sent to the attention of the TPOC at: (Email Address of the TPOC, e.g. jane.doe@navy.mil). The subject line of the email shall read "ONR BAA 14-009 White Paper Submission." The white paper must be a Microsoft Word 2007 compatible, or PDF format attachment to the email. There is an email size limit of 5MB per email.

NOTE:

- 1. Do not send hardcopies of White Papers (including Facsimiles) as only electronic submissions will be accepted and reviewed;**
- 2. Do not send .ZIP files.**
- 3. Do not send password protected files.**

In order to provide traceability and evidence of submission, Offerors may wish to use the "Delivery Receipt" option available from Microsoft Outlook and other email programs that will automatically generate a response when the subject email is delivered to the recipient's email system. Consult the User's Manual for your email software for further details on this

feature.

White Paper Content

- **Cover Page:** The Cover Page shall be labeled "WHITE PAPER", and shall include the BAA number, proposed title, Offeror's administrative and technical points of contact, with telephone numbers, facsimile numbers, and Internet addresses, and shall be signed by an authorized officer.
- **White Paper Technical Content:** A description of the technology innovation and technical risk areas.

Cover Page: The Cover Page shall be labeled "WHITE PAPER", and shall include the BAA number, proposed title, Offeror's administrative and technical points of contact, with telephone numbers, facsimile numbers, and Internet addresses, and shall be signed by an authorized officer.

- White Paper Technical Content: A description of the technology innovation and technical risk areas.
- Technical Concept: A five (5) page technical section which clearly describes the objectives of the proposed effort, technical issues to be resolved to accomplish objectives, the technical approach proposed to resolve these issues, an assessment of the proposed new capability over the existing state of the art, and a comparison against competing technological developments. This section shall include references.
- Rough Order of Magnitude (ROM)

b. FULL PROPOSALS

i. INSTRUCTIONS FOR CONTRACTS, COOPERATIVE AGREEMENTS AND OTHER TRANSACTION AGREEMENTS (Does not include Grants)

NOTE: Submission instructions for BAAs issued after FY 2010 have changed significantly from previous requirements. Potential Offerors are advised to carefully read and follow the instructions below. The new format and requirements have been developed to streamline and ease both the submission and the review of proposals.

Proposal Package: The following four documents with attachments comprise a complete proposal package:

- (1) *Technical Proposal Template (pdf)*
- (2) *Technical Content (word)*
- (3) *Cost Proposal Spreadsheet (excel)*
- (4) *Adequacy Checklist for Pre Award Audit (SF 1408) (as applicable)*

These documents can be found at: <http://www.onr.navy.mil/Contracts-Grants/submit-proposal/contracts-proposal/cost-proposal.aspx>. All have instructions imbedded into them that will assist in completing the documents. Also, both the Technical Proposal Template and the Cost Proposal Spreadsheet require completion of cost-related information. Please note that attachments can be incorporated into the Technical Proposal Template for submission.

For proposals below the simplified acquisition threshold (less than or equal to \$150K), the Technical Proposal Template and Technical Content documents, and Cost Proposal Spreadsheet are required. In addition, if a purchase order will be awarded, the effort will be fixed price. Purchase orders can also contain options, if authorized under the BAA, as long as the total amount of the base and all options does not exceed \$150k.

Intellectual Property: Offerors responding to this BAA must submit a separate list of all technical data or computer software that will be furnished to the Government with other than unlimited rights. The Government will assume unlimited rights if offerors fail to identify any intellectual property restrictions in their proposals. Include in this section all proprietary claims to results, prototypes, and/or deliverables. If no restrictions are intended, then the offeror shall state "NONE."

The format requirements for any attachments are as follows:

- Paper Size- 8.5 x 11 inch paper
- Margins – 1 inch
- Spacing- single or double spaced
- Font- Times New Roman, 12 point

For proposed subcontracts or interorganizational transfers over \$150,000, Offerors must provide a separate fully completed Cost Proposal Spreadsheet in support of the proposed costs. This spreadsheet, along with supporting documentation, must be provided either in a sealed envelope with the prime's proposal or via e-mail directly to both the Program Officer and the Business Point of Contact at the same time the prime proposal is submitted. The e-mail shall identify the proposal title, the prime Offeror and that the attached proposal is a subcontract, and shall include a description of the effort to be performed by the subcontractor.

Offerors shall submit one (1) electronic copy on CD-ROM as discussed with the cognizant Program Officer, of their proposal package. The electronic copy shall be submitted in a secure, pdf-compatible format, except for the electronic file for the Cost Proposal Spreadsheet which shall be submitted in a Microsoft Excel 2007 compatible format. All attachments shall be submitted in a secure, pdf-compatible format.

The secure pdf-compatible format is intended to prevent unauthorized editing of the proposal prior to any award. A password shall not be required for opening the proposal document, but the Government must have the ability to print and copy text, images, and other content. Offerors may also submit their Technical Proposal Template and Content in an electronic file that allows for revision (preferably in Microsoft Word) to facilitate the communication of potential revisions. Should an Offeror amend its proposal, the amended proposal shall be submitted following the same hard and electronic copy guidance applicable to the original proposal.

Any proposed options that are identified in the Technical Proposal Template or Technical Content documents, but are not fully priced out in the Cost Proposal Spreadsheet, will not be included in any resulting contract, cooperative agreement, or other transaction. If proposing options, they **must** be separately priced and separate spreadsheets shall be provided for the base period and each option. In addition to providing summary by period of performance (base and any options), the Contractor is also responsible for providing a breakdown of cost for each task identified in the Statement of Work. The sum of all costs by task worksheets **MUST** equal the total cost summary.

The electronic submission of the Excel spreadsheet shall be in a "useable condition" to aid the Government with its evaluation. The term "useable condition" indicates that the spreadsheet shall visibly include and separately identify within each appropriate cell any and all inputs, formulas, calculations, etc. The Offeror shall not provide "value only spreadsheets" similar to a hard copy.

Fixed Fees on ONR Contracts: The Government Objective is set in accordance with the DFARS 215.404-71. See the below table for range and normal values:

Contract Risk Factor	Contract Type	Assigned Value (Normal range)	Normal Value
Technical (1)		3% - 7% (2)	5%
Management/Cost Control (1)		3% - 7% (2)	5%
Contract Type Risk	Firm Fixed Price	2% - 6% (3)	3% - 5% (4)
Contract Type Risk	Cost Plus Fixed Fee	0% - 1% (2)	0.5%

1. Assign a weight (percentage) to each element according to its input to the total performance risk. The total of the two weights equal 100 percent.
2. Assign a weighting score relative to the Risk Factor.
3. Depends on the specific Contract Type (With/without financing, performance-based payments, and/or progress payments).
4. Depends on the specific Contract Type.

Technology Incentive (TI) is rarely utilized at ONR, because the contracts issued by ONR typically are not eligible for TI (See DFARS 215.404-71-2(c)(2)). Any consideration of TI requires strong and convincing justification in the proposal, which are then subject to negotiation and determination of a fair and reasonable fee, within the context of the specific award. Typically the range of fee is 5% to 7.5% on an ONR awarded contract.

For submission instructions, see sub-section F. Submission of White Papers and Full Proposals for Contracts, Cooperative Agreements, and Other Transaction Agreements.

ii. INSTRUCTIONS FOR GRANTS

The following information must be completed as follows in the SF 424 located on www.grants.gov to ensure that the application is directed to the correct individual for review: **Block 4a**, Federal Identifier: Enter the previous ONR award number, or **N00014** if the application is not a renewal or expansion of an existing award; **Block 4b**, Agency Routing Number: **Enter the three (3) digit Program Office Code and the Program Officer's name, last name first, in brackets (i.e., [Shifler, David])**. Applicants who fail to provide a Program Officer code identifier may receive a notice that their proposal is rejected.

To attach the technical proposal in Grants.gov, download the application package

Click on "Research and Related Other Project Information"

Click on "Move form to Submission List"

Click on "Open Form"

You will see a new PDF document titled "Research & Related Other Project Information"

Block 7 is the Project Summary/Abstract -> click on "Add attachment" and attach the project summary/abstract. (You will not be able to type in the box, therefore, save the file you want to attach as Project Summary or Abstract).

Block 8 is the Project Narrative -> click on Add attachment and attach the technical proposal. (Save the file as Volume I- Technical Proposal since you will not be able to type in the box).

Full Proposal Format - Volume 1 - Technical Proposal and Volume 2 - Cost Proposal

- Paper Size - 8.5 x 11 inch paper
- Margins - 1 inch
- Spacing - single-spaced
- Font - Times New Roman, 12 point
- Number of Pages - Volume (Vol. 1) is limited to no more than 20 pages. Limitations within sections of the proposal, if any, are indicated in the individual descriptions shown below. The cover page, table of contents, resumes and current and pending project and proposal submissions information are excluded from the page limitations. Full Proposals exceeding the page limit may not be evaluated. There are no page limitations to Volume 2.
- Copies - the full proposal shall be submitted electronically at <http://www.grants.gov> as delineated in paragraph 5 below.

Volume 1: Technical Proposal

- **Cover Page:** This shall include the words "Technical Proposal" and the following:
 1. BAA number 14-009;
 2. Title of Proposal;
 3. Identity of prime Offeror and complete list of subawards, if applicable;
 4. Technical contact (name, address, phone/fax, electronic mail address)
 5. Administrative/business contact (name, address, phone/fax, electronic mail address) and;
 6. Proposed period of performance (identify both the base period and any options, if included);
 7. Signature of Authorized Representative.
- **Table of Contents:** An alphabetical/numerical listing of the sections within the proposal, including corresponding page numbers.
- **Technical Approach and Justification:** The major portion of the proposal shall consist of a clear description of the technical approach being proposed. This discussion shall provide the technical foundation / justification for pursuing this particular approach / direction and why one would expect

it to enable the objectives of the proposal to be met.

Project Schedule and Milestones: A summary of the schedule of events and milestones.

Reports:

The following are sample reports that are typically required under a research effort:

- Technical and Financial Progress Reports
- Presentation Materials
- Final Report

Grants do not include the delivery of software, prototypes, and other hardware deliverables.

Current and Pending Project and Proposal Submissions: Offerors are required to provide information on all current and pending support for ongoing projects and proposals, including subsequent funding in the case of continuing contracts, grants, and other assistance agreements. Offerors shall provide the following information of any related proposal submissions from whatever sources (e.g., ONR, Federal, State, local or foreign government agencies, public or private foundations, industrial or other commercial organizations).

The information must be provided for all proposals already submitted or submitted concurrently to other possible sponsors, including ONR. Concurrent submission of a proposal to other organizations will not prejudice its review by ONR:

- 1) Title of Proposal and Summary;
- 2) Source and amount of funding (annual direct costs; provide contract and/or grant numbers for current contracts/grants);
- 3) Percentage effort devoted to each project;
- 4) Identity of prime Offeror and complete list of subawards, if applicable;
- 5) Technical contact (name, address, phone/fax, electronic mail address)
- 6) Administrative/business contact (name, address, phone/fax, electronic mail address);
- 7) Duration of effort (differentiate basic effort);
- 8) The proposed project and all other projects or activities requiring a portion of time of the Principal Investigator and other senior personnel must be included, even if they receive no salary support from the project(s);
- 9) The total award amount for the entire award period covered (including indirect costs) must be shown as well as the number of person-months or labor hours per year to be devoted to the project, regardless of source of support; and
- 10) State how projects are related to the proposed effort and indicate degree of overlap.

Qualifications: A discussion of the qualifications of the proposed Principal Investigator and any other key personnel. Include resumes for the Principal Investigator and other key personnel and full curricula vitae for Principal Investigators and consultants. The resumes and curricula vitae shall be attached to the proposal and will not count toward the page limitations.

VOLUME 2: Cost Proposal

The offeror must use the Grants.gov forms (including the Standard Form (SF) Research and Related (R&R) Budget Form) from the application package template associated with the BAA on the Grants.gov web Site located at <http://www.grants.gov/>. If options are proposed, the cost proposal must provide the pricing information for the option periods; failure to include the proposed costs for the option periods will result in the options not being included in the award. Assume that performance will start no earlier than 4 months after the date the cost proposal is submitted. A separate Adobe .pdf document shall be included in the application that provides appropriate justification and/or supporting documentation for each element of cost proposed.

Part 1: The itemized budget must include the following

- Direct Labor - Individual labor categories or persons, with associated labor hours and unburdened direct labor rates. Provide escalation rates for out years.

Administrative and clerical labor – Salaries of administrative and clerical staff are normally indirect costs (and included in an indirect cost rate). Direct charging of these costs may be appropriate when a major project requires an extensive amount of administrative or clerical support significantly greater than normal and routine levels of support. Budgets proposing direct charging of administrative or clerical salaries must be supported with a budget justification which adequately describes the major project and the administrative and/or clerical work to be performed.

- Fringe Benefits and Indirect Costs - (i.e., F&A, Overhead, G&A, etc) - The proposal shall show the rates and calculation of the costs for each rate category. If the rates have been approved/negotiated by a Government agency, provide a copy of the memorandum/agreement. If the rates have not been approved/negotiated, provide sufficient detail to enable a determination of allowability, allocability and reasonableness of the allocation bases, and how the rates are calculated. Additional information may be requested, if needed. If composite rates are used, provide the calculations used in deriving the composite rates.
- Travel -The proposed travel cost shall include the following for each trip: the purpose of the trip, origin and destination if known, approximate duration, the number of travelers, and the estimated cost per trip must be justified based on the organizations historical average cost per trip or other reasonable basis for estimation. Such estimates and the resultant costs claimed must conform to the applicable Federal cost principals. Offerors may include travel costs for the Principal Investigator to attend the peer reviews described in Section II of this BAA.
- Subawards/subcontracts Subawards/subcontracts - Provide a description of the work to be performed

by the subrecipient/subcontractor. For each subaward, a detailed cost proposal is required to be submitted by the subrecipient(s). A proposal and supporting documentation must be received and reviewed before the Government can complete its cost analysis of the proposal and enter negotiations. ONR's preferred method of receiving subcontract information is for this information to be included with the Prime's proposal. However, a subcontractor's cost proposal can be provided in a sealed envelope with the recipient's cost proposal or via e-mail directly to the Program Officer at the same time the prime proposal is submitted. The e-mail shall identify the proposal title, the prime Offeror and that the attached proposal is a subcontract. See bullet below regarding Fee/profit guidance for subawards/subcontracts.

- Consultants - Provide a breakdown of the consultant's hours, the hourly rate proposed, any other proposed consultant costs, a copy of the signed Consulting Agreement or other documentation supporting the proposed consultant rate/cost, and a copy of the consultant's proposed statement of work if it is not already separately identified in the prime contractor's proposal.
- Materials & Supplies - Provide an itemized list of all proposed materials and supplies including quantities, unit prices, and the basis for the estimate (e.g., quotes, prior purchases, catalog price lists).
- Recipient Acquired Equipment or Facilities - Equipment and/or facilities are normally furnished by the Recipient. If acquisition of equipment and/or facilities is proposed, a justification for the purchase of the items must be provided. Provide an itemized list of all equipment and/or facilities costs and the basis for the estimate (e.g., quotes, prior purchases, catalog price lists). Allowable items normally are limited to research equipment not already available for the project. General purpose equipment (i.e., equipment not used exclusively for research, scientific or other technical activities, such as personal computers, laptops, office equipment) shall not be requested unless they will be used primarily or exclusively for the project. For computer/laptop purchases and other general purpose equipment, if proposed, include a statement indicating how each item of equipment will be integrated into the program or used as an integral part of the research effort.
- Other Direct Costs - Provide an itemized list of all other proposed other direct costs such as Graduate Assistant tuition, laboratory fees, report and publication costs, and the basis for the estimate (e.g., quotes, prior purchases, catalog price lists).

NOTE: If the grant proposal is for a conference, workshop or symposium:

1. *ONR will not sponsor ONR, Navy, or DoD driven event. Provide a list of other sponsors and the requested amounts to be funded by all sponsors.*
 2. *The funds provided by ONR may be used to pay for food or beverages as a direct cost only in exceptional circumstances. The funds will not be used for food or beverages unless*
 - a. *the grant proposal contains a request for such funding that is fully supported factually in accordance with the cost principles of the relevant OMB Circular, and*
 - b. *the grants officer determines that the funding is a reasonable, allocable, allowable expense under the relevant cost principles.*
- Options - The Base Period of Performance and Option Periods must be priced at the submission of the proposal. Unpriced options will not be included in any resulting award or agreement.
 - Fee/Profit - Fee/profit is unallowable under assistance agreements at either the prime or subaward level but may be permitted on any subcontracts issued by the prime awardee.

Part 2 - Cost breakdown by Government fiscal year and task/sub-task corresponding to the same task

breakdown in the proposed Statement of Work. When options are contemplated, options must be separately identified and priced by task/subtask.

C. Significant Dates and Times -

Event	Date	Time
Pre-Proposal Conference / Industry Day	6/24/2014	12:00 PM Eastern Standard Time
White Paper Due Date	7/18/2014	0:00 PM Eastern Standard Time
Notification of White Paper Evaluation*	8/15/2014	
Oral Presentations*	9/11/2014	
Notification of Oral Presentation Evaluation*	9/18/2014	
Full Proposal Due Date	10/3/2014	0:00 PM Eastern Standard Time
Notification of Selection: Full Proposals*	10/24/2014	
Awards*	3/24/2015	

**These dates are estimates as of the date of this announcement.*

NOTE: Due to changes in security procedures since September 11, 2001, the time required for hard-copy written materials to be received at the Office of Naval Research has increased. Materials submitted through the U.S. Postal Service, for example, may take seven days or more to be received, even when sent by Express Mail. Thus any hard-copy proposal shall be submitted long enough before the deadline established in the solicitation so that it will not be received late and thus be ineligible for award consideration.

D. Submission of Late Proposals -

Any proposal, modification, or revision that is received at the designated Government office after the exact time specified for receipt of proposals is "late" and will not be considered unless it is received before award is made, the contracting officer determines that accepting the late proposal would not unduly delay the acquisition and:

- a. If it was transmitted through an electronic commerce method authorized by the announcement, it was received at the initial point of entry to the Government infrastructure not later than 5:00 P.M. one working day prior to the date specified for receipt of proposals; or
- b. There is acceptable evidence to establish that it was received at the Government installation designated for receipt of proposals and was under the Government's control prior to the time set for receipt of proposals; or

c. It was the only proposal received.

However, a late modification of an otherwise timely and successful proposal that makes its terms more favorable to the Government will be considered at any time it is received and may be accepted.

Acceptable evidence to establish the time or receipt at the Government installation includes the time/date stamp of that installation on the proposal wrapper, other documentary evidence of receipt maintained by the installation, or oral testimony or statements of Government personnel.

If an emergency or unanticipated event interrupts normal Government processes so that proposals cannot be received at the Government office designated for receipt of proposals by the exact time specified in the announcement, and urgent Government requirements preclude amendment of the announcement closing date, the time specified for receipt of proposals will be deemed to be extended to the same time of day specified in the announcement on the first work day on which normal Government processes resume.

The contracting officer must promptly notify any offeror if its proposal, modifications, or revision was received late and must inform the offeror whether its proposal will be considered.

E. Submission of Grant Proposals through Grants.gov

Detailed instructions entitled "Grants.Gov Electronic Application and Submission Information" on how to submit a Grant proposal through Grants.gov are under the Submit Proposals section of the website at <http://www.onr.navy.mil/Contracts-Grants/submit-proposal/grants-proposal/grants-gov.aspx>

White Papers shall not be submitted through the Grants.gov Apply process, but rather shall be sent directly to ONR. White Papers shall be e-mailed directly to the Technical Point of Contact. White Paper format requirements are found in Section IV, item 2a above.

By completing Block 17, the Grant Applicant is providing the certification on lobbying required by 32 CFR Part 28. Refer to Section VI, "Award Administration Information" entitled "Certifications" for further information.

For electronic submission of grant full proposals, there are several one-time actions that must be completed in order to submit an application through Grants.gov. These include obtaining a Dun and Bradstreet Data Universal Numbering System (DUNS) number, registering with the System for Award Management (SAM), registering with the credential provider, and registering with Grants.gov. See www.grants.gov, specifically www.grants.gov/GetStarted.

Use the Grants.gov Organization Registration Checklist at http://www.grants.gov/applicants/register_your_organization.jsp which will provide guidance through the process. Designating an E-Business Point of Contact (EBiz POC) and obtaining a special password called 'MPIN' are important steps in the SAM registration process. Applicants who are not registered with SAM.gov and Grants.gov should allow at least 21 days to complete these requirements. The process should be started as soon as possible. Any questions relating to the registration process, system requirements, how an application form works, or the submittal process **must** be directed to Grants.gov at 1-800-518-4726 (1-

606-545-5035 for foreign applicants) or support@grants.gov.

Special Notices Relative to Grant Applications to be submitted through Grants.Gov:

All attachments to grant applications submitted through Grants.Gov must be in Adobe Portable Document Format (i.e., .PDF files). Proposals with attachments submitted in word processing, spreadsheet, or any format other than Adobe Portable Document Format will not be considered for award.

Applicants who have registered with Grants.gov are urged to submit their proposals electronically *at least* three days before the date and time that proposals are due so that they will not be received late and be ineligible for award consideration.

Proposal Receipt Notices:

After a full proposal is submitted through Grants.gov, the Authorized Organization Representative (AOR) will receive a series of three e-mails. It is extremely important that the AOR watch for and save each of the e-mails. You will know that your proposal has reached ONR when the AOR receives e-mail Number 3. You will need the Submission Receipt Number (e-mail Number 1) to track a submission. The three e-mails are:

Number 1 - The applicant will receive a confirmation page upon completing the submission to Grants.gov. This confirmation page is a record of the time and date stamp that is used to determine whether the proposal was submitted.

Number 2 - The applicant will receive an e-mail indicating that the proposal has been validated by Grants.gov within two days of submission (this means that all of the required fields have been completed). After an institution submits an application, Grants.gov generates a submission receipt via email and also sets the application status to "Received." This receipt verifies the Application has been successfully delivered to the Grants.gov system. Next, Grants.gov verifies the submission is valid by ensuring it does not contain viruses, the opportunity is still open, and the applicant login and applicant DUNS number match. If the submission is valid, Grants.gov generates a submission validation receipt via email and sets the application status to "Validated." If the application is not validated, the application status is set to "Rejected." The system sends a rejection email notification to the institution, and the institution must resubmit the application package. Applicants can track the status of their application by logging in to Grants.gov.

Number 3 - The third notice is an acknowledgement of receipt in e-mail form from ONR within ten days from the proposal due date, if applicable. The e-mail is sent to the authorized representative for the institution. The e-mail for proposals notes that the proposal has been received and provides the assigned tracking number.

F. Address for the Submission of White Papers and Full Proposals for Contracts.

White Papers must be emailed to Dr. Carey Schwartz at the following email address: carey.schwartz@navy.mil. The DVD or CD-ROM of the Full Proposal including all supporting documentation shall be sent to the Office of Naval Research at the following address:

Primary Contact	Secondary Contact
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Office of Naval Research Attn: Dr. Carey Schwartz ONR Department Code: 311 875 North Randolph Street Arlington, VA 22203-1995	Office of Naval Research Attn: Ms. Kim McCormick ONR Department Code: 311 875 North Randolph Street Arlington, VA 22203-1995
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V. EVALUATION INFORMATION

A. Evaluation Criteria -

Awards under this BAA will be made to proposers on the basis of the evaluation criteria listed below, and program balance to provide overall value to the Government. The Government reserves the right to request any additional, necessary documentation once it makes the award instrument determination. The Government reserves the right to remove proposers from award consideration should the parties fail to reach agreement on award terms, conditions, and cost/price within a reasonable time, or the proposer fails to timely provide requested additional information. Evaluations will be conducted using the following evaluation criteria:

1. Overall scientific and technical merits of the proposal;
2. The qualifications, capabilities and experience of the proposed Principal Investigator (PI), team leader and key personnel who are critical in achieving the proposal objectives;
3. The offeror's capabilities, related experience, facilities, techniques or unique combinations of these which are integral factors for achieving the proposal objectives;
4. Potential Naval relevance and contributions of the effort to the agency's specific mission and
5. The realism of the proposed costs and availability of funds.

Criteria 1 - 4 above are significantly more important than Criteria 5, and Criteria 1 through 4 are of equal value. The primary bases for selecting proposals for acceptance shall be technical importance to agency programs and fund availability. Cost realism and reasonableness shall also be considered to the extent appropriate.

The ultimate recommendation for award of proposals is made by ONR's scientific/technical community. Recommended proposals will be forwarded to the ONR contracts department. Any notification received from ONR that indicates that the Offeror's full proposal has been recommended, does not ultimately guarantee an award will be made. This notice indicates that the proposal has been selected in accordance with the evaluation criteria above and has been sent to the contracting department to conduct cost analysis, determine the offeror's responsibility, and take other relevant steps necessary prior to commencing negotiations with the offeror.

B. Commitment to Small Business - (For Contract Awards Only)

The Office of Naval Research is strongly committed to providing meaningful subcontracting opportunities for small businesses, small disadvantaged businesses (SDBs), woman-owned small businesses (WOSBs), historically underutilized business zone (HUBZone) small businesses, veteran-owned small business (VOSBs), service disabled veteran-owned small businesses (SDVOSBs), historically black colleges and universities, and minority institutions, and other concerns subject to socioeconomic considerations through

its awards.

For businesses unfamiliar with doing business with the government and require assistance may contact the state-specific Department of Defense (DoD) Procurement Technical Assistance Center (PTAC). DoD PTACs serve as a resource for businesses pursuing and performing under contracts with DoD, other federal agencies, state and local governments and with government prime contractors. Assistance provided by the PTACs is usually free of charge. PTAC support includes registration in systems such as SAM, identification of contract opportunities, understanding requirements and preparing and submitting proposals. The PTACs have a presence in each state, Puerto and Guam. To locate a local PTAC visit:

<http://www.dla.mil/SmallBusiness/Pages/ProcurementTechnicalAssistanceCenters.aspx> or <http://www.aptac-us.org/new/>.

1) Subcontracting Plan - For proposed awards to be made as contracts that exceed \$650,000, large businesses and non-profits (including educational institutions) shall provide a Subcontracting Plan (hereafter known as the 'Plan') that contains all elements required by FAR Subpart 19.704, FAR 52.219-9 and as supplemented by DFARS 252.219-7003.

NOTE: Small businesses are exempt from this requirement.

The Plan shall be submitted as an attachment to the "Technical Proposal Template" and will not be included in the page count. If a company has a Master Subcontracting Plan, as described in FAR 19.701 or a Comprehensive Subcontracting Plan, as described in DFARS 219.702, a copy of the Plan shall also be submitted as an attachment to the "Technical Proposal Template".

Plans will be reviewed for adequacy, ensuring that the required information, goals, and assurances are included. FAR 19.702 require the apparently successful offeror to submit an acceptable Plan. If the apparently successful offeror fails to negotiate a Plan acceptable to the contracting officer within the time limit prescribed by the contracting officer, the offeror will be ineligible for award.

Offerors shall propose a plan that ensures small businesses (inclusive of SDBs, WOSBs, HUBZone, VOSBs and SDVOSBs, etc...) will have the maximum practicable opportunity to participate in contract performance consistent with its efficient performance.

As a baseline, offerors shall to the best extent possible propose realistic goals to ensure small business participation in accordance with the current or most recent fiscal year subcontracting goals found on the DoD Office of Small Business Program website at: <http://www.acq.osd.mil/osbp/>. If proposed goals are below the statutory requirements, then the offeror shall included in the Plan a viable written explanation as to why small businesses are unable to be utilized and what attempts were taken to ensure that small business were given the opportunity to participate in the effort to the maximum extent practicable.

2) Small Business Participation Statement –

If subcontracting opportunities exist, all prime Offerors shall submit a Small Business Participation Statement regardless of size in accordance with DFARS 215.304 when receiving a contract for more than the simplified acquisition threshold (i.e., \$150,000). All offerors shall provide a statement of the extent of the offeror's commitment in providing meaningful subcontracting opportunities for small businesses and

other concerns subject to socioeconomic considerations through its awards and must agree that small businesses, VOSBs, SDVOSBs, HUBZones, SDBs, and WOSBs concerns will have to the maximum practicable opportunity to participate in contract performance consistent with its efficient performance.

This assertion will be reviewed to ensure that it supports this policy by providing meaningful subcontracting opportunities. The statement shall be submitted as a part of the proposal package and will not be included in the page count.

3) Subcontracting Resources -

Subcontracting to a prime contractor can be a good way to participate in the contracting process. The following is a list of potential resources that may assist in locating potential subcontracting partners/opportunities:

- Companies Participating in DoD Subcontracting Program Report
- DAU Small Business Community of Practice (SB COP)
- DefenseLink = \$6.5M Award Notices
- DoD OSBP Prime Contractors and Subcontractors with Subcontracting Plans
- Dynamic Small Business Search
- Electronic Subcontracting Reporting System (eSRS)
- Federal Business Opportunities (FEDBIZOPPS)
- Navy SBIR/STTR Search – Website or Brochure
- DoD Procurement Technical Assistance Centers (PTAC)
- Small Business Administration (SBA) Subcontracting Opportunities Directory
- SBA Subnet

For a description and associated websites visit the ONR Office of Small Business webpage at: <http://www.onr.navy.mil/Contracts-Grants/small-business.aspx>.

For example, in accordance with FAR Subpart 5.206, entities may transmit a notice to a Government Point of Entry (GPE) to seek competition for subcontracts and to increase participation by qualified HUBZone small business, small, small disadvantaged business, women-owned small business, veteran-owned small business and service-disabled veteran-owned small business concerns is encouraged, and to meet established subcontracting plan goal as follows:

- (a) A contractor awarded a contract exceeding \$150,000 that is likely to result in the award of any subcontracts;
- (b) A subcontractor or supplier, at any tier, under a contract exceeding \$150,000, that has a subcontracting opportunity exceeding \$15,000.

The notices must describe-

- (a) The business opportunity;
- (b) Any prequalification requirements; and
- (c) Where to obtain technical data needed to respond to the requirement.

An example of a GPE is the SBA SUB-Net which is a place in which prime contractors may post solicitations or sources sought notices for small business. The SUB-Net database provides a listing of subcontracting solicitations and opportunities posted by large prime contractors and other non-federal agencies.

C. Options -

The Government will evaluate options for award purposes by adding the total cost for all options to the total cost for the basic requirement. Evaluation of options will not obligate the Government to exercise the options during the period of performance.

D. Evaluation Panel -

Technical and cost proposals submitted under this BAA will be protected from unauthorized disclosure in accordance with FAR 3.104-4 and 15.207. The cognizant Program Officer and other Government scientific experts will perform the evaluation of technical proposals. Restrictive notices notwithstanding, one or more support contractors may be utilized as subject-matter-expert technical consultants. However, proposal selection and award decisions are solely the responsibility of Government personnel. Each support contractor's employee having access to technical and cost proposals submitted in response to this BAA will be required to sign a non-disclosure statement prior to receipt of any proposal submissions.

VI. AWARD ADMINISTRATION INFORMATION

- A. North American Industry Classification System (NAICS) code - The NAICS code for this announcement is "541712" with a small business size standard of "500 employees".
- B. System for Award Management (SAM): All Offerors submitting proposals or applications must:
 - a. be registered in the SAM prior to submission;
 - b. maintain an active SAM registration with current information at all times during which it has an active Federal award or an application under consideration by any agency; and
 - c. provide its DUNS number in each application or proposal it submits to the agency.

The System for Award Management (SAM) is a FREE WEBSITE that consolidates the capabilities you used to find in CCR/FedReg, ORCA, and EPLS. Future phases of SAM will add the capabilities of other systems used in Federal procurement and awards processes.

SAM may be accessed at <https://www.sam.gov/portal/public/SAM/>

- C. Access to your Grant, Cooperative Agreement, Other Transaction and Contract Award

Effective 01 October 2011, hard copies of award/modification documents are no longer be mailed to Offerors. All Office of Naval Research (ONR) award/modification documents will be available via the Department of Defense (DoD) Electronic Document Access System (EDA).

EDA is a web-based system that provides secure online access, storage, and retrieval of awards and modifications to DoD employees and vendors.

If you do not currently have access to EDA, complete a self-registration request as a "Vendor" via <http://eda.ogden.disa.mil> following the steps below:

Click "New User Registration" (from the left Menu)
Click "Begin VENDOR User Registration Process"
Click "EDA Registration Form" under Username/Password (enter the appropriate data)
Complete & Submit Registration form

Allow five (5) business days for your registration to be processed. EDA will notify you by email when your account is approved.

Registration questions may be directed to the EDA help desk toll free at 1-866-618-5988, Commercial at 801-605-7095, or via email at cscassig@csd.disa.mil (Subject: EDA Assistance)

VII. OTHER INFORMATION

A. Applies to Grant, Cooperative Agreement and Other Transaction Agreement applications only:

i. Federal Funding Accountability and Transparency Act of 2006:

The Federal Funding Accountability and Transparency Act of 2006 (Public Law 109-282), as amended by Section 6202 of Public Law 110-252, requires that all agencies establish requirements for recipients reporting information on subawards and executive total compensation as codified in 2 CFR 33.110. Any company, non-profit agency or university that applies for financial assistance (either grants, cooperative agreements or other transaction agreements) as either a prime or sub-recipient under this BAA must provide information in their proposal that describes the necessary processes and systems in place to comply with the reporting requirements identified in 2 CFR 33.220 and Appendix A. Entities are **exempt** from this requirement **UNLESS** in the preceding fiscal year, it received: a) 80 percent or more of its annual gross revenue in Federal contracts (and subcontracts), loans, grants (and subgrants), and cooperative agreements; b) \$25 million or more in annual gross revenue from Federal contracts (and subcontracts), loans, grants (and subgrants), and cooperative agreements; and c) the public does not have access to information about the compensation of the senior executives through periodic reports filed under section 13(a) or 15(d) of the Securities Exchange Act of 1934 or section 6104 of the Internal Revenue Code of 1986.

ii. Military Recruiting On Campus (DoDGARS Part 22.520)

This applies to domestic U. S. colleges and universities. Appropriate language from 32CFR22.520 Campus access for military recruiting and Reserve Officer Training Corps (ROTC) will be incorporated in all university grant awards.

iii. Certification regarding Restrictions on Lobbying: :

Grant and Cooperative Agreement awards greater than \$100,000, as well as OTAs not under Section 845, require a certification of compliance with a national policy mandate concerning lobbying. Grant, applicants shall provide this certification by electronic submission of SF424

(R&R) as a part of the electronic proposal submitted via Grants.gov (complete Block 17). The following certification applies likewise to each cooperating agreement and normal OTA applicant seeking federal assistance funds exceeding \$100,000:

1. No Federal appropriated funds have been paid or will be paid by or on behalf of the applicant, to any person for influencing or attempting to influence an officer or employee of an agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.
2. If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the Federal contract, grant, loan, or cooperative agreement, the applicant shall complete and submit Standard Form-LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.
3. The applicant shall require that the language of this certification be included in the award documents for all subawards at all tiers (including subcontracts, subgrants, and contracts under grants, loans, and cooperative agreements) and that all subrecipients shall certify and disclose accordingly.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by Section 1352, title 31, U.S.C. Any person who fails to file the required certification shall be subject to a civil penalty of not less than \$10,000 and not more than \$100,000 for each such failure.

iv. Representation Regarding an Unpaid Delinquent Tax Liability or a Felony Conviction Under any Federal Law - DOD Appropriations:

All grant applicants are required to complete the "Representation on Tax Delinquency and Felony Conviction" found at <http://www.onr.navy.mil/Contracts-Grants/submit-proposal/grants-proposal.aspx> by checking the "I agree" box in block 17 and attaching the representation to block 18. of the SF424 (R&R) as part of the electronic proposal submitted via Grants.gov. The representation reads as follows:

1. The applicant represents that it is ___ is not___ a corporation that has any unpaid Federal tax liability that has been assessed, for which all judicial and administrative remedies have been exhausted or have lapsed, and that is not being paid in timely manner pursuant to an agreement with the authority responsible for collecting the tax liability
2. The applicant represents that it is__ is not __a corporation that was convicted of a felony criminal violation under any Federal law within the preceding 24 months.

NOTE: If an applicant responds in the affirmative to either of the above representations, the

applicant is ineligible to receive an award unless the agency suspension and debarment official (SDO) has considered suspension or debarment and determined that further action is not required to protect the Government's interests. The applicant therefore shall provide information about its tax liability or conviction to the agency's SDO as soon as it can do so, to facilitate completion of the required consideration before award decisions are made.

B. Applies to Contracts only:

- i. Government Property/Government Furnished Equipment (GFE) and Facilities

RESERVED

- ii. Use of Arms, Ammunition and Explosives:

RESERVED

- iii. System for Award Management (SAM):

FAR 52.204-7 System for Award Management and FAR 52.204-13 System for Award Management Maintenance are incorporated into this BAA, and FAR 52.204-13 will be incorporated in all awards.

- iv. Employment Eligibility Verification:

As per FAR 22.1802, recipients of FAR-based procurement contracts must enroll as Federal Contractors in E-verify and use E-verify to verify employment eligibility of all employees assigned to the award. All resultant contracts from this solicitation will include FAR 52.222-54, "Employment Eligibility Verification."

- v. FAR / DFARS Clauses:

The following are examples of clauses that may be incorporated into an ONR contract:

#	Clause
52.204-7	System for Award Management
52.215-16	Facilities Capital Cost of Money
52.215-22	Limitations on Pass Through Charges - Identification of Subcontract Effort
52.216-1	Type of Contract
52.216-27	Single or Multiple Awards
52.217-4	Evaluation of Options Exercised at time of Contract Award
52.217-5	Evaluation of Options
52.222-24	Preaward On-Site Equal Opportunity Compliance Evaluation (Applies if exceeds \$10M)
25.226-2	Historically Black College or University and Minority Institution Representation

52.230-7	Proposal Disclosure - Cost Accounting Practice Changes
52.232-15	Progress Payments not included
52.233-2	Service of Protest
52.252-1	Solicitation Provisions Incorporated by Reference
52.252-3	Alterations in Solicitation
52.252-5	Authorized Deviations in Provisions
252.203-7005	Representation Relating to Compensation of Former DoD Officials
252.204-7004	Alternate A, System for Award Management
252.215-7003	Requirements for Submission of Data Other than Certified Cost or Pricing Data - Canadian Commercial Corporation

vi. Combating Trafficking in Persons

Appropriate language from FAR Clause 52.222-50 will be incorporated in all awards.

vii. Updates of Information regarding Responsibility Matters

FAR clause 52.209-9, Updates of Publicly Available Information Regarding Responsibility Matter, will be included in all contracts valued at \$500,000 where the contractor has current active Federal contracts and grants with total value greater than \$10,000,000.

C. Applies to all:

i. Security Classification

RESERVED

ii. Use of Animals and Human Subjects in Research

RESERVED

iii. Recombinant DNA

RESERVED

iv. Department of Defense High Performance Computing Program

RESERVED

v. Organizational Conflicts of Interest

RESERVED

vi. Project Meetings and Reviews

Individual program reviews between the ONR sponsor and the performer may be held as

necessary. Program status reviews may also be held to provide a forum for reviews of the latest results from experiments and any other incremental progress towards the major demonstrations. These meetings will be held at various sites throughout the country. For costing purposes, offerors should assume that 40% of these meetings will be at or near ONR, Arlington VA and 60% at other contractor or government facilities. Interim meetings are likely, but these will be accomplished via video telephone conferences, telephone conferences, or via web-based collaboration tools.

vii. Executive Compensation and First-Tier Subcontract Reporting (APPLIES ONLY TO CONTRACTS)

The FAR clause 52.204-10, "Reporting Executive Compensation and First-Tier Subcontract Awards," will be used in all procurement contracts valued at \$25,000 or more. Other Guidance, Instructions, and Information

None

DEPARTMENT OF DEFENSE CONTRACT SECURITY CLASSIFICATION SPECIFICATION <i>(The requirements of the DoD Industrial Security Manual apply to all security aspects of this effort.)</i>				1. CLEARANCE AND SAFEGUARDING		SER:098-14	
				a. FACILITY CLEARANCE REQUIRED		SECRET	
2. THIS SPECIFICATION IS FOR: <i>(X and complete as applicable)</i>				3. THIS SPECIFICATION IS: <i>(X and complete as applicable)</i>			
a. PRIME CONTRACT NUMBER		X		a. ORIGINAL <i>(Complete date in all cases)</i>		DATE (YYYYMMDD) 20140619	
b. SUBCONTRACT NUMBER				b. REVISED <i>(Supersedes all previous specs)</i>		REVISION NO. DATE (YYYYMMDD)	
X c. SOLICITATION OR OTHER NUMBER BAA14-009		DUE DATE (YYYYMMDD)		c. FINAL <i>(Complete item 5 in all cases)</i>		DATE (YYYYMMDD)	
4. IS THIS A FOLLOW-ON CONTRACT?				NO: If Yes, complete the following:			
<input type="checkbox"/> YES		<input checked="" type="checkbox"/> NO		Classified material received or generated under _____ <i>(Preceding Contract Number)</i> is transferred to this follow-on contract.			
5. IS THIS A FINAL DD FORM 254?				NO: If Yes, complete the following:			
<input type="checkbox"/> YES		<input checked="" type="checkbox"/> NO		In response to the contractor's request dated _____, retention of the classified material is authorized for the period of _____			
6. CONTRACTOR <i>(Include Commercial and Government Entity (CAGE) Code)</i>							
a. NAME, ADDRESS, AND ZIP CODE		b. CAGE CODE		c. COGNIZANT SECURITY OFFICE <i>(Name, Address, and Zip Code)</i>			
For White Paper Responses to BAA				N/A			
7. SUBCONTRACTOR							
a. NAME, ADDRESS, AND ZIP CODE		b. CAGE CODE		c. COGNIZANT SECURITY OFFICE <i>(Name, Address, and Zip Code)</i>			
N/A				N/A			
8. ACTUAL PERFORMANCE							
a. LOCATION		b. CAGE CODE		c. COGNIZANT SECURITY OFFICE <i>(Name, Address, and Zip Code)</i>			
N/A				N/A			
9. GENERAL IDENTIFICATION OF THIS PROCUREMENT							
Development of a robust Naval Data Science foundation that addresses data representations and ontologies required to support a wide range of Naval Warfare Mission Areas							
10. CONTRACTOR WILL REQUIRE ACCESS TO:							
	YES	NO	11. IN PERFORMING THIS CONTRACT, THE CONTRACTOR WILL:				
a. COMMUNICATIONS SECURITY (COMSEC) INFORMATION		X	a. HAVE ACCESS TO CLASSIFIED INFORMATION ONLY AT ANOTHER CONTRACTOR'S FACILITY OR A GOVERNMENT ACTIVITY			X	
b. RESTRICTED DATA		X	b. RECEIVE CLASSIFIED DOCUMENTS ONLY			X	
c. CRITICAL NUCLEAR WEAPON DESIGN INFORMATION		X	c. RECEIVE AND GENERATE CLASSIFIED MATERIAL	X			
d. FORMERLY RESTRICTED DATA		X	d. FABRICATE, MODIFY, OR STORE CLASSIFIED HARDWARE			X	
e. INTELLIGENCE INFORMATION			e. PERFORM SERVICES ONLY			X	
(1) Sensitive Compartmented Information (SCI)		X	f. HAVE ACCESS TO U.S. CLASSIFIED INFORMATION OUTSIDE THE U.S., PUERTO RICO, U.S. POSSESSIONS AND TRUST TERRITORIES			X	
(2) Non-SCI		X	g. BE AUTHORIZED TO USE THE SERVICES OF DEFENSE TECHNICAL INFORMATION CENTER (DTIC) OR OTHER SECONDARY DISTRIBUTION CENTER			X	
f. SPECIAL ACCESS INFORMATION		X	h. REQUIRE A COMSEC ACCOUNT			X	
g. NATO INFORMATION		X	i. HAVE TEMPEST REQUIREMENTS			X	
h. FOREIGN GOVERNMENT INFORMATION		X	j. HAVE OPERATIONS SECURITY (OPSEC) REQUIREMENTS			X	
i. LIMITED DISSEMINATION INFORMATION		X	k. BE AUTHORIZED TO USE THE DEFENSE COURIER SERVICE			X	
j. FOR OFFICIAL USE ONLY INFORMATION	X		l. OTHER <i>(Specify)</i>			X	
k. OTHER <i>(Specify)</i>		X					

12. PUBLIC RELEASE. Any information (*classified or unclassified*) pertaining to this contract shall not be released for public dissemination except as provided by the Industrial Security Manual or unless it has been approved for public release by appropriate U.S. Government authority. Proposed public releases shall be submitted for approval prior to release Direct Through (*Specify*)

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to the Directorate for Freedom of Information and Security Review, Office of the Assistant Secretary of Defense (Public Affairs)* for review.
 *In the case of non-DoD User Agencies, requests for disclosure shall be submitted to that agency.

13. SECURITY GUIDANCE. The security classification guidance needed for this classified effort is identified below. If any difficulty is encountered in applying this guidance or if any other contributing factor indicates a need for changes in this guidance, the contractor is authorized and encouraged to provide recommended changes; to challenge the guidance or the classification assigned to any information or material furnished or generated under this contract; and to submit any questions for interpretation of this guidance to the official identified below. Pending final decision, the information involved shall be handled and protected at the highest level of classification assigned or recommended. (*Fill in as appropriate for the classified effort. Attach, or forward under separate correspondence, any documents/guides/extracts referenced herein. Add additional pages as needed to provide complete guidance.*)

Develop white papers and full proposals to address capabilities in support of a robust Naval Big Data Ecosystem that enables more sophisticated and powerful analytics for supporting Naval Warfighting applications. Capabilities to be provided are in the following four Thrust Areas: (1) Development of a robust Naval Data Science foundation that addresses data representations and ontologies required to support a wide range of Naval Warfare Mission Areas; (2) Identifying, acquiring, ingesting, and indexing Data Sources pertinent to Naval Warfighting Missions; (3) Development of advanced analytics for Naval Warfare Mission Areas; and (4) Development of data protection and security mechanisms to ensure the integrity of data used throughout the analytic process.

Access to and generation of classified information is not required for the purpose of submitting a White Paper or Proposal for this BAA. However, in the event a classified white paper is submitted in response to this BAA, classified white papers will not be returned to the offers and will be destroyed by ONR.

ONR Classified Mailing Address:

Office of Naval Research
 Attn: Document Control
 One Liberty Center
 875 N. Randolph Street
 Arlington, VA 22203-1995
 POC is Carey Schewartz, Code 311

14. ADDITIONAL SECURITY REQUIREMENTS. Requirements, in addition to ISM requirements, are established for this contract. Yes No
 (*If Yes, identify the pertinent contractual clauses in the contract document itself, or provide an appropriate statement which identifies the additional requirements. Provide a copy of the requirements to the cognizant security office. Use Item 13 if additional space is needed.*)

15. INSPECTIONS. Elements of this contract are outside the inspection responsibility of the cognizant security office. Yes No
 (*If Yes, explain and identify specific areas or elements carved out and the activity responsible for inspections. Use Item 13 if additional space is needed.*)

16. CERTIFICATION AND SIGNATURE. Security requirements stated herein are complete and adequate for safeguarding the classified information to be released or generated under this classified effort. All questions shall be referred to the official named below.

a. TYPED NAME OF CERTIFYING OFFICIAL Diana Pacheco (diana.pacheco@navy.mil)	b. TITLE Contracting Officer for Security Matters	c. TELEPHONE (<i>Include Area Code</i>) (703) 696-8177
d. ADDRESS (<i>Include Zip Code</i>) Office of Naval Research One Liberty Center, 875 N. Randolph Street Arlington, VA 22203-1995	17. REQUIRED DISTRIBUTION <input checked="" type="checkbox"/> a. CONTRACTOR <input type="checkbox"/> b. SUBCONTRACTOR <input checked="" type="checkbox"/> c. COGNIZANT SECURITY OFFICE FOR PRIME AND SUBCONTRACTOR <input type="checkbox"/> d. U.S. ACTIVITY RESPONSIBLE FOR OVERSEAS SECURITY ADMINISTRATION <input type="checkbox"/> e. ADMINISTRATIVE CONTRACTING OFFICER <input checked="" type="checkbox"/> f. OTHERS AS NECESSARY ONR 311, 43, 25	
e. SIGNATURE 		

ONR BAA 14-009

Advanced Analytics and Data Science for Naval Warfare Planning and Execution

Questions and Answers Amendment 01

WHITE PAPER QUESTIONS (from Industry Day)

Question 1: Was ONR implying the Intelligence Community Cloud was just for SIGINT.

Answer: No. The reference to the Intelligence Community Cloud as being a SIGINT cloud was an exemplar. There was no intent to imply that the Intelligence Community cloud is limited to SIGINT only.

Question 2: Who has purview over the Navy's Integrated Fires activities and how are they feeding requirements into the work under this BAA?

Answer: OPNAV N2N6 has the lead for Integrated Fires. N2N6, PEO C4I, PEO IWs, as well as NAVAIR and NAVSEA will be involved in the review of white papers and proposals under this BAA and ONR's selections will therefore take their requirements into account. A big part of this BAA is to facilitate information sharing across these Naval communities in ways that cannot be done today.

Question 3: How is data cleansing accomplished in the Naval Tactical Cloud?

Answer: Data cleansing can be accomplished using the Artifacts Models within the Naval Tactical Cloud. This allows data cleansing to occur within the STORM processing bolts. Data Cleansing can also be performed upstream of the STORM Processing within the NiagaraFiles workflow environment. Finally, there opportunities for running Java scripts within the Naval Tactical Cloud Platform, which could be used to perform data cleansing.

Question 4: Can the Naval Tactical Cloud support unstructured data?

Answer: Yes. Naval Tactical Cloud includes a set of natural language processing capabilities and is specifically designed to support unstructured data through all stages of the analytic process.

Question 5: Are the mapping (as discussed in the Artifact and Object Models) deterministic mappings or probabilistic models?

Answer: At this point mappings defined in Artifact and Object Models are deterministic, not probabilistic.

Question 6: How important for this effort is it to use Open Source tools?

Answer: Open Source is very important, particularly for software tools that are used to enhance the Naval Tactical Cloud platform. For highly capable analytics and applications that ride on top of the Naval Tactical Cloud foundation, Open Source is not as critical; however, all things being equal, Open Source solutions will be looked upon more favorably.

Question 7: How fast can the Naval Tactical Cloud generate alerts?

Answer: There is no single answer to this question. The time required to generate alerts on the Naval Tactical Cloud platform is highly dependent on the complexity of the data being ingested, the amount of semantic extraction and enrichment being performed, and the complexity of the processing that is required to generate the alerts.

Question 8: Are there tools in the Naval Tactical Cloud that would allow you on the fly to map new Concepts and Predicates to existing Concepts and Predicates?

Answer: Yes. The Naval Tactical Cloud contains Concept and Predicate Association Tables that would allow one to define and store relationships between new Concepts and Predicates with existing Concepts and Predicates. These associations would have to be generated using either a MapReduce Job or in-line STORM processing.

Question 9: How will the Data Focused Naval Tactical Cloud address software safety and weapons safety certification?

Answer: First, the work under this effort will not involve combat/weapon systems and will therefore not have to address such certification. The intent is to ingest data from combat and weapon systems to perform more advanced analytics, however, that will not require combat/weapon system certification. Second, as an S&T effort, work under this BAA will take capabilities to Technology Readiness Level 6. It will be up to the Programs of Records that receive the resulting technology to continue to harden the technology and to obtain the appropriate software certification and accreditations.

Question 10: Will there be an interface between Naval Tactical Cloud and other large data stores such as the DCGS-N Enterprise Node (DEN) or imagery stores provided by NGA?

Answer: Yes. Examining information exchanges between the afloat Naval Tactical Cloud and other large Cloud Data Stores is of high interest for this effort. ONR is interested in looking at how to pre-load a Naval Tactical Cloud instance with the right data from other Data Clouds, as well as how to exchange data while at sea and while operation under D-DIL (Denied/Disconnected, Intermittent, or Low-Bandwidth) conditions.

Question 11: Is there an interest in augmenting the how data is stored within Accumulo Tables within the Naval Tactical Cloud, with graph/triple stores approaches?

Answer: Yes. ONR is currently extending the Naval Tactical Cloud platform to support storing metadata in graph/triple format using RDF and providing a SPARQL interface. Capabilities that build on graph/triple stores are of interest, however, it will be important maintain cell level security.

Question 12: How will Naval Tactical Cloud be interoperable with the IC ITE Cloud?

Answer: The Naval Tactical Cloud is built on the same foundation as the Army's IC ITE Cloud (formerly called Red Disk) and is therefore completely interoperable with the Army Cloud. The Naval Tactical Cloud shares many elements in common with the Intelligence Community's IC ITE Cloud. However, there are differences in some areas, as well as different practices in how the Cloud is locked down and managed. Capabilities from the intelligence community that can be adapted to address Naval problems should be portable to the Naval Tactical Cloud, albeit with some additional work in some cases to address the current differences.

Question 13: Does Naval Tactical Cloud use Ozone Widget Framework?

Answer: Yes.

Question 14: What are the types and kinds of data that will be available for analytic purposes within the Naval Tactical Cloud?

Answer: There is no predetermined set of data that will be available in the Naval Tactical Cloud. ONR is interested in hearing from the proposers what data ought to be incorporated into the Naval Tactical Cloud to help improve Naval Warfighting capabilities.

Question 15: Can proposers have access to the Naval Tactical Cloud source code for review?

Answer: No. ONR does not intend to make Naval Tactical Cloud source code available to any organization prior to the award of a contract.

Question 16: Does ONR intent to make documentation for use of the Naval Tactical Platform available to proposers?

Answer: No. As for source code, Naval Tactical Cloud documentation will only be provided to organizations that are awarded a contract under this BAA.

Question 17: How do we reconcile the interests of representing and dealing with uncertainty in Naval combat systems with the current constraints on dealing with uncertainty in the Naval Tactical Cloud?

Answer: While the Naval Tactical Cloud has yet to address representing uncertainty in relationships, there is nothing precluding this from being done, and in fact, is something that is of great interest in pursuing under this BAA. From a combat systems perspective, relationships will often have an element of uncertainty, and therefore long term it is important to be able to represent that uncertainty and provide the mechanisms for providing that uncertainty information to those who need it. In supporting the combat system, it is also important to be able characterize the sources of information and analytics so that only appropriate information is used to support fire control decisions.

Question 18: Human input and judgment is important in many Naval warfare applications. Is this BAA interested in proposals that include human interaction?

Answer: Yes. However, this BAA is more focused on Data Science and analytics aspects of developing the Naval Tactical Cloud foundation. Starting in FY16, more emphasis will be placed on addressing Human aspects of interacting with the Naval Tactical Cloud.

Question 19: With regard to ASW analytics, is the BAA more interested in pursuing real-time analytics or forensics?

Answer: Real-time analytics are the higher priority.

Question 20: Has ASW data from MH-60R helicopters already been ingested into the Naval Tactical Cloud?

Answer: Not yet. However, there are ongoing efforts in FY14 to ingest data from MH-60Rs into the Naval Tactical Cloud. We anticipate the availability of some MH-60R data by the start of the work under this BAA.

Question 21: What was meant by improved Spectrum Operations?

Answer: Spectrum Operations is another term for Electromagnetic Maneuver Warfare. Both terms refer to the ability to fully operate and maneuver across the complete electromagnetic spectrum and to fully coordinate all aspects of spectrum activities including communications, sensing, electronic attack, electronic defense, and cyber. Improving Spectrum Operations in the context of this BAA means developing the Data Science and advanced analytics to help improve how the Naval community conducts Spectrum Operations.

Question 22: What types of environmental data does the BAA want to take advantage of?

Answer: Any environmental data that can help improve tactical Naval Warfare, especially ASW and IAMD.

Question 23: Are the challenges of bringing data into the Naval Tactical Cloud primarily a technology challenge or a process challenge?

Answer: There are both technology and process/policy challenges. ONR intends to take on the process/policy challenges of bringing data into the Cloud where that is required.

Question 24: Is there interest in looking at open source information and social media information, and if so, what is of interest?

Answer: Yes Open Source is fair game. We look to proposers to tell us what open source/social media information is important and how it can help improve Naval Warfighting capabilities.

Question 25: Could you address the apparent inconsistency in looking for significant improvement in the ability to generate and manage data representations and semantics without seeking significant investment in new tools and infrastructure?

Answer: Our primary objective is to improve our ability to build out the data representations and semantics required to support Naval Warfare, not it developing new tools and infrastructure to do so. If new tools and infrastructure can facilitate the primary goal of building out Naval data representations and semantics, then we be interested in considering them. However, proposals for new tools and infrastructure must be coupled with the use of those new tools and infrastructure to produce actual Naval data representations and semantics. In terms of how we see speeding up the development of data representations and semantics without new tools, we believe that lack of domain expertise about the data is typically more of an impediment to rapid progress than the current tool set. We therefore encourage proposers

who are interested in this the Data Science thrust to include appropriate domain experts as part of your team.

Question 26: What metrics are being used to judge the quality of semantics? How do we know when we have a good product vs. a bad product?

Answer: Currently we do not have explicit metrics for measuring the suitability of semantics. We intend to include domain experts from the Naval community to evaluate proposals for developing semantics and will leverage this expertise to judge the quality of what is proposed.

Question 27: Is the National Information Exchange Model (NIEM) domain of milops relevant to this BAA and does the Navy consider this relevant to Naval data representation semantics?

Answer: Yes. ONR would be interested in how NIEM can contribute to building out Naval data representations and semantics within the Naval Tactical Cloud.

Question 28: Will ONR consider special indexes such as multi-dimensional databases that support things such as pair-wise correlation and time series analysis?

Answer: Yes, ONR will consider all indexing ideas, provided they provide a compelling case for improving Naval Warfighting capabilities.

Question 29: Will ONR be providing data or is ONR looking for proposers to be able to bring all of the data they need on their own?

Answer: ONR understands that real Naval data sources are under the control of various Naval organizations and that proposers cannot on their own obtain access to those data sources. ONR is looking to proposers to identify what data sources are needed to implement their data science and analytic ideas. ONR will then take responsibility for working with the appropriate organizations to make that data available.

Question 30: For ASW analytics, is ONR more interested specifically in acoustic data sources and analytics or interested in a wider range of data sources and analytics?

Answer: Although the Industry brief examples for ASW focused on acoustic data and analytics, ONR is interested all types of data sources and analytics that can be used to improve ASW. Some specific non-acoustic sources that are of interest include National Technical Means and radar (for periscope detection).

Question 31: For the ASW exemplar, how would a US submarine performing those analytics communicate with other US Naval platforms to share data?

Answer: Yes. US submarines can communicate with other US platforms. However, their ability to share data will be extremely limited and at times not possible. ASW analytics must account for the realities of communication constraints among US Naval platforms.

Question 32: Is there interest in looking to larger shore based Clouds to augment the limited processing and storage capabilities that can be put aboard US ships and submarines?

Answer: ONR would be open to good ideas where shore-based analytics can enhance the warfighting capabilities of tactical operating forces. However, the primary focus of the BAA is enabling tactical Naval forces to operate in the most challenging A2AD (Anti-Access/Area Denial) and D-DIL (Denied/Disconnected, Intermittent, and Low Bandwidth) conditions. In such conditions there will be extremely limited, or possibly no bandwidth between the shore and afloat forces. Therefore, approaches that are heavily dependent on shore-based capabilities will be looked on less favorably than approaches that will be robust to A2AD/D-DIL conditions.

Question 33: To what extent is this BAA interested in entertaining ideas that include aspects of game theory and the ability to make warfighting recommendations?

Answer: ONR would be very interested capabilities that incorporate game theory capabilities to provide warfighting recommendations.

Question 34: What is the available funding for the BAA over the five years of the period?

Answer: The available funding for this BAA is provided in solicitation.

Question 35: Is PMW120 the only transition agent for the technology under this BAA?

Answer: No. Although PMW120 is a primary transition agent (for DCGS-N Inc 2), other Naval organizations are expected to be transition agents including PMW150 (for MTC2), PMW130 (for Cyber Situational Awareness), as well as organizations within PEO IWS, PEO Sub, and PEO LCS.

Question 36: How are ONR's current contractors working on Naval Tactical Cloud accessing the Naval Tactical Cloud software for development purposes?

Answer: ONR currently provides VPN access to contractor partners to access Naval Tactical Cloud software as Virtual Machines that can be downloaded and used by contractors to develop on the Naval Tactical Cloud platform. Note, access to classified data sources is not supported in this manner. All processing of classified data occurs on site at ONR's primary Naval Tactical Cloud development facilities.

Question 37: What is ONR's plan for making real world data available to performers to both develop and test analytics?

Answer: ONR plans to make real-world data available to performers as part of this effort. In most cases, the classified nature of the data will require analytic development and testing to be performed at ONR's primary Naval Tactical Cloud development facilities. In addition the DCGS-N Inc 2 program intends to make data sets available to support the work under this BAA.

Question 38: Please clarify how classified proposals will can be submitted, but the resulting contract will be unclassified?

Answer: The intent is that the contract vehicle for a classified effort will be unclassified. In other words, classified work can be performed without making the contract vehicle itself classified. An unclassified contract vehicle can still allow for classified work to be performed and for classified deliverables to be provided. However, the contract vehicle itself would not have to be treated as classified.

Question 39: What methods does ONR envision employing to evaluate and assess capabilities developed under this BAA in tactically relevant environments? Is ONR looking at using a simulation tool like JDEP or hardware in the loop?

Answer: ONR will determine the specific evaluation and assessment tools to be used for evaluating and assessing capabilities based on what is appropriate for the capability in question.

Question 40: Is there interest in looking at analytics to help prioritize data flows in constrained A2AD/D-DIL conditions?

Answer: Yes.

Question 41: Will ONR distribute information on the program structure and key government personnel associated with this BAA?

Answer: Once awards are made, ONR will make that information available to performers, but will not provide that information to proposers.

Question 42: Does ONR have a preference for smaller individual proposals or for larger efforts where a prime contractor manages a team of subcontractors?

Answer: No. ONR has no preference. Proposers should use their judgment as to which type of arrangement would be best suited for their proposed effort.

Question 43: Will ONR publish the list of Industry Day attendees?

Answer: No.

Data Focused Naval Tactical Cloud (DF-NTC)



ONR Information Package

June 24, 2014



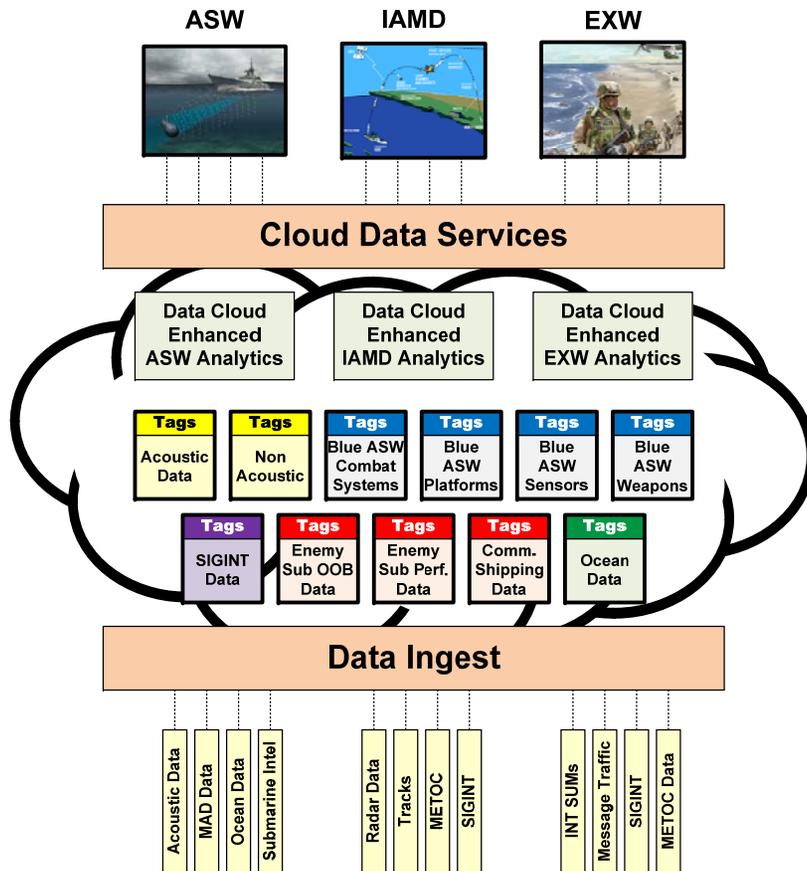
ONR Information Package Components

- Part #1** **DF-NTC EC Overview**
- Part #2** **NTC Overview**
- Part #3** **Developing on the NTC Platform**
- Part #4** **Data Science Thrust**
- Part #5** **Data Ingest and Indexing Thrust**
- Part #6** **Analytic Thrust / ASW**
- Part #7** **Analytic Thrust / IAMD**
- Part #8** **Security Thrust**

Part #1

DF-NTC EC Overview

DF-NTC Enabling Capability



- Data-driven decision support shaped by commander's intent, historical decisions/results, COA/ECOA . . .
- Advanced analytics to support effective/rapid planning, assessment & execution
 - ASW
 - IAMD
 - EXW
- Autonomous predictive SA across warfare domains
- Adaptive fleet-wide data sharing in DIL environment
- Data protection and security mechanisms to ensure the integrity of data
- Automated data security tagging at ingest

S&T Objectives

- **Develop efficient, effective ingestion capabilities for ASW, IAMD, & EXW data in support of broad Naval needs**
 - NTM, acoustic, radar, EO/IR, ESM, METOC . . .
- **Develop efficient analytic techniques & algorithms that extract critical, mission-focused, insight & present timely I&W from volumes of disparate ingested data**
- **Develop widgets & applications for cloud environment that provide enhanced C2 capabilities**
 - Electronic representation Naval Plans
 - Automated assessment of operational impacts to Naval Plans
 - Automated planning & re-planning aligned with Commander's Intent

Warfighting Payoff

- Ability for Naval Warfare Area commanders to more effectively & rapidly plan, assess & execute operations by employing advanced analytics that leverage cross-Warfare data

Co-evolution of CONOPS/TTPs with Data & Analytics S&T Products

Part #2

NTC Overview

Cloud Computing Context

IT Efficiency Clouds



Purpose: Consolidate enterprise computing for cost savings

- Located at Large Data Centers
- Supports 10,000s of customers
- Operates on high bandwidth networks

IT Efficiency Clouds are mature and can make the Navy IT infrastructure more cost effective

Naval Tactical Cloud (NTC)



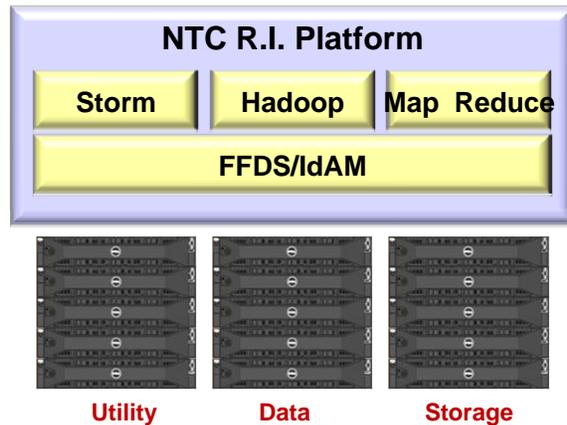
Purpose: Improve warfighting effectiveness while operating inside adversary kill chains

- Cloud located at the tactical edge supporting real-time mission planning and execution
- Applications automate diverse sensor and data assimilation
- Operates on tactical RF networks

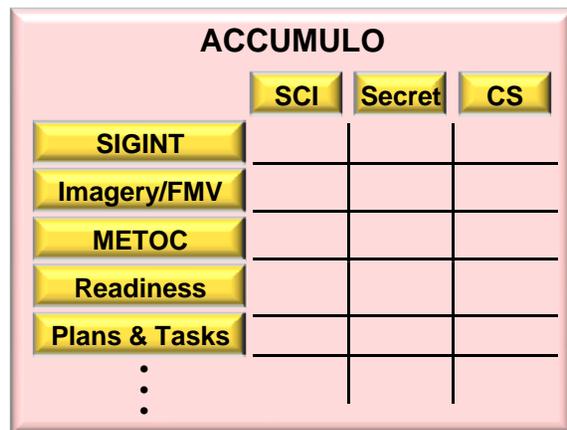
Tactical Clouds are emerging and have the potential to radically improve Navy combat effectiveness

NTC RI Platform

Massive Storage & Compute Platform Core & Common Services



All Source, Big Data UCD Framework

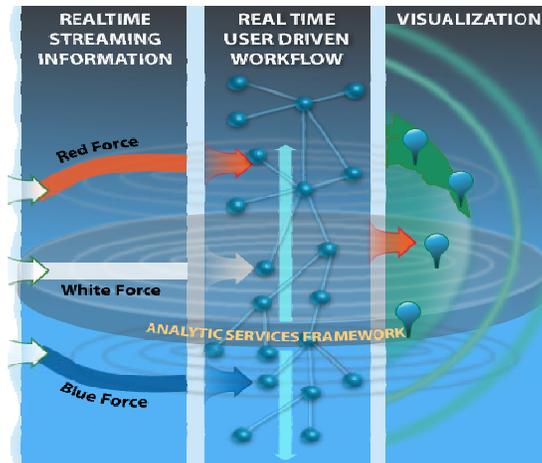


SAVA

Highly Tailorable, Quickly Developed Apps & Widgets

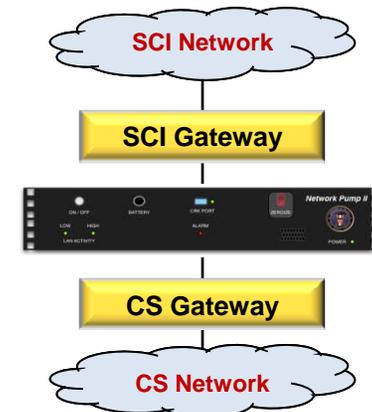


High Performance Data Analytics/Predictive Analysis



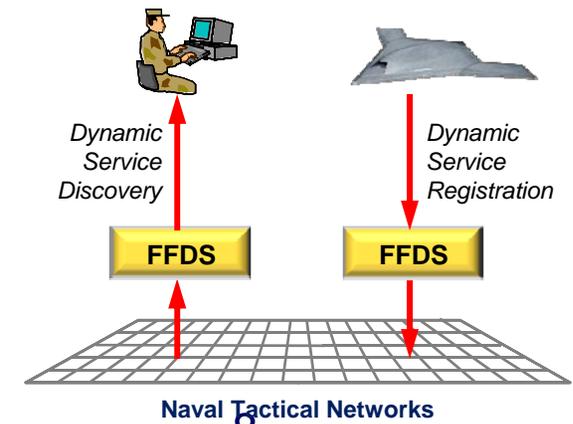
UGW/PUMP II

High Performance, Cross-Domain Gateways

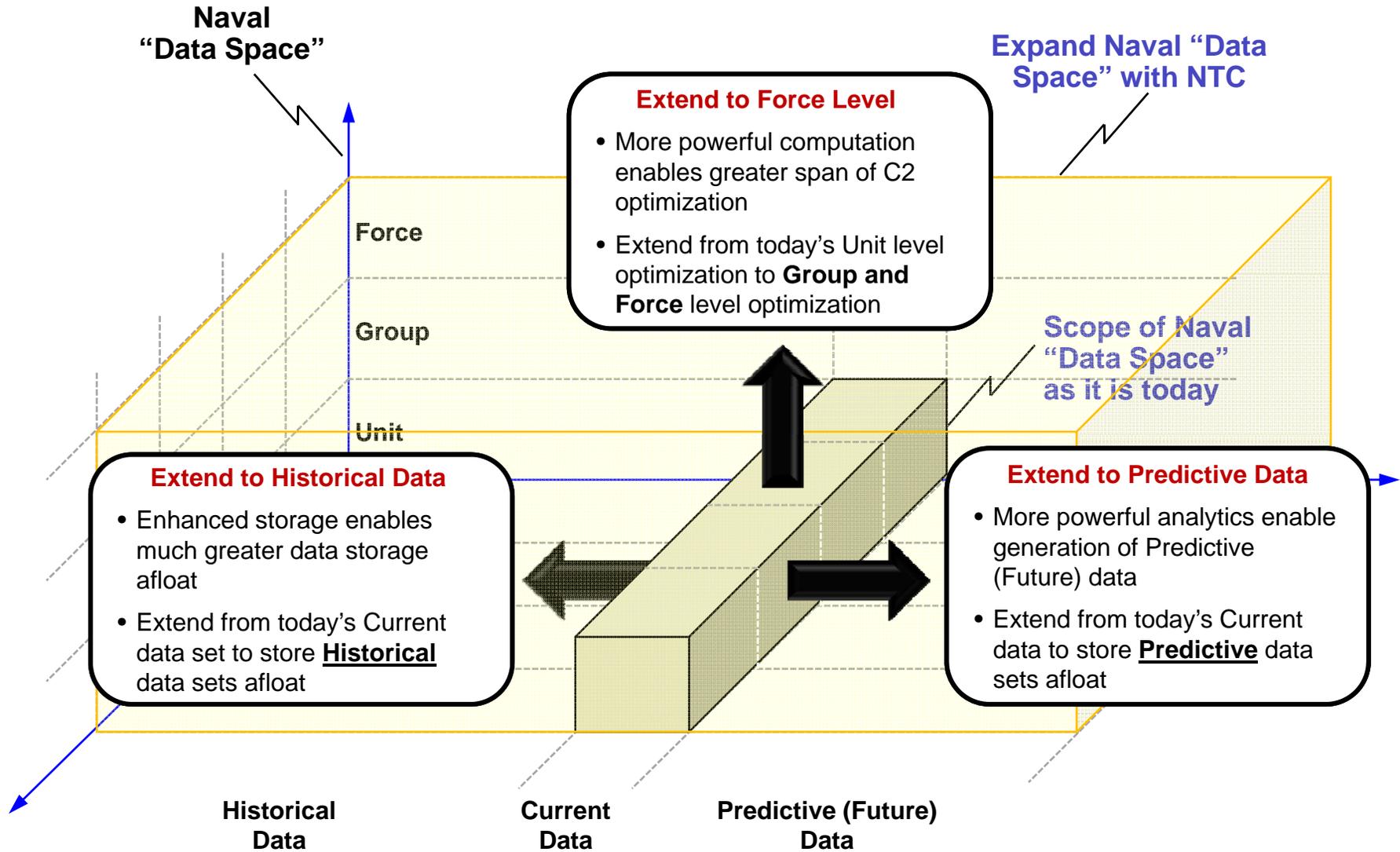


FFDS

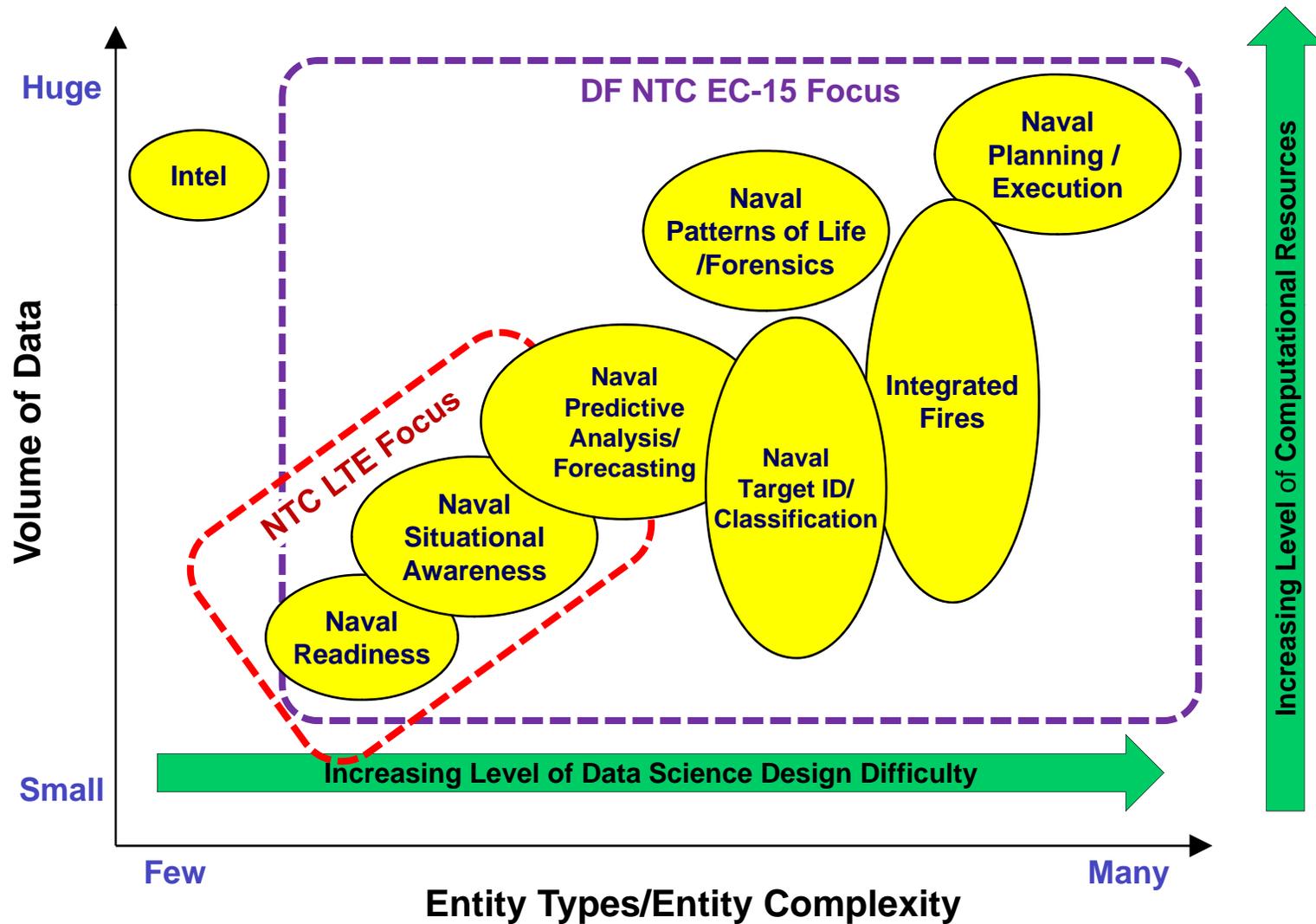
Dynamic Federation & Discovery Services for D-DIL



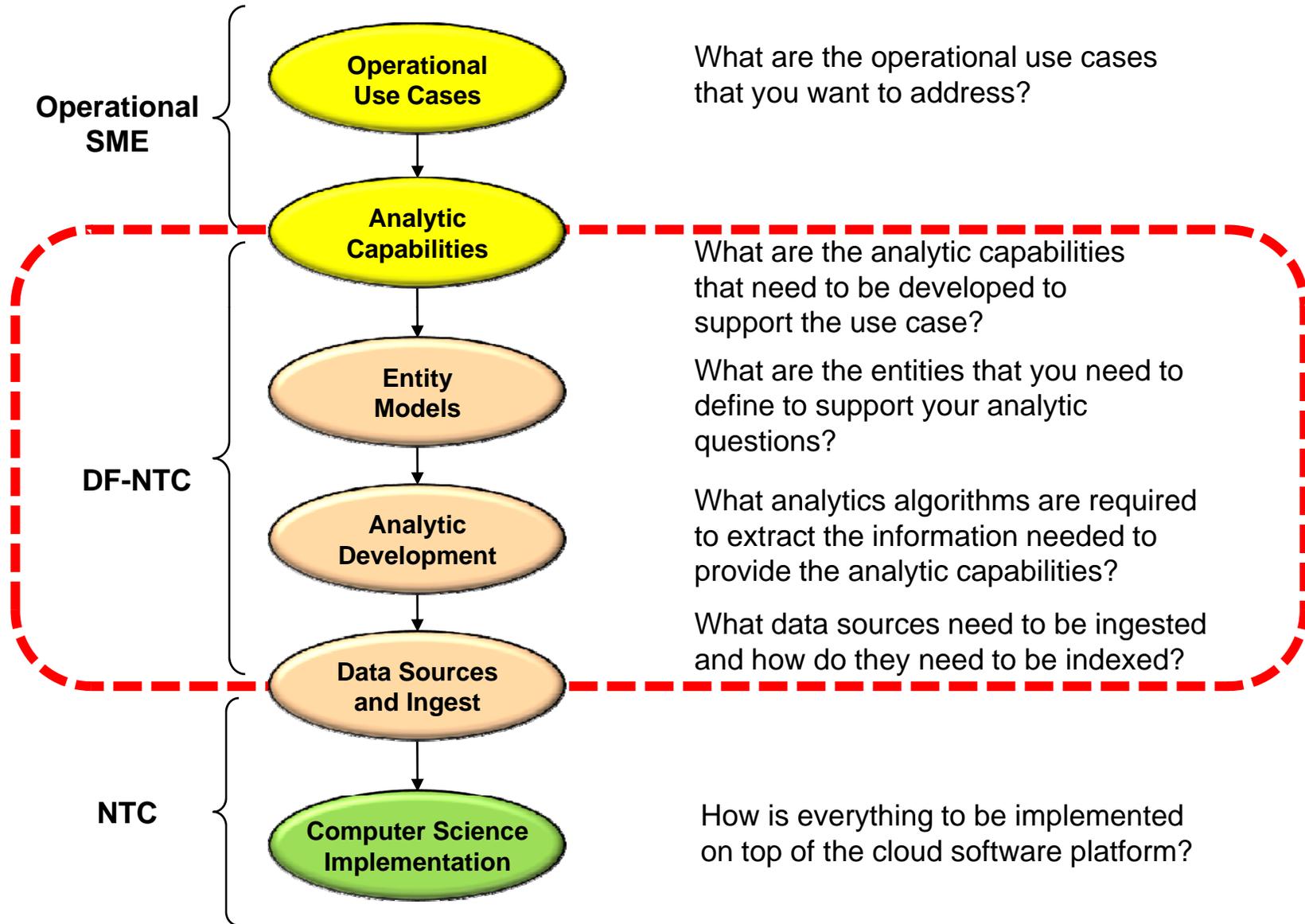
Harnessing the Complete Naval "Data Space"



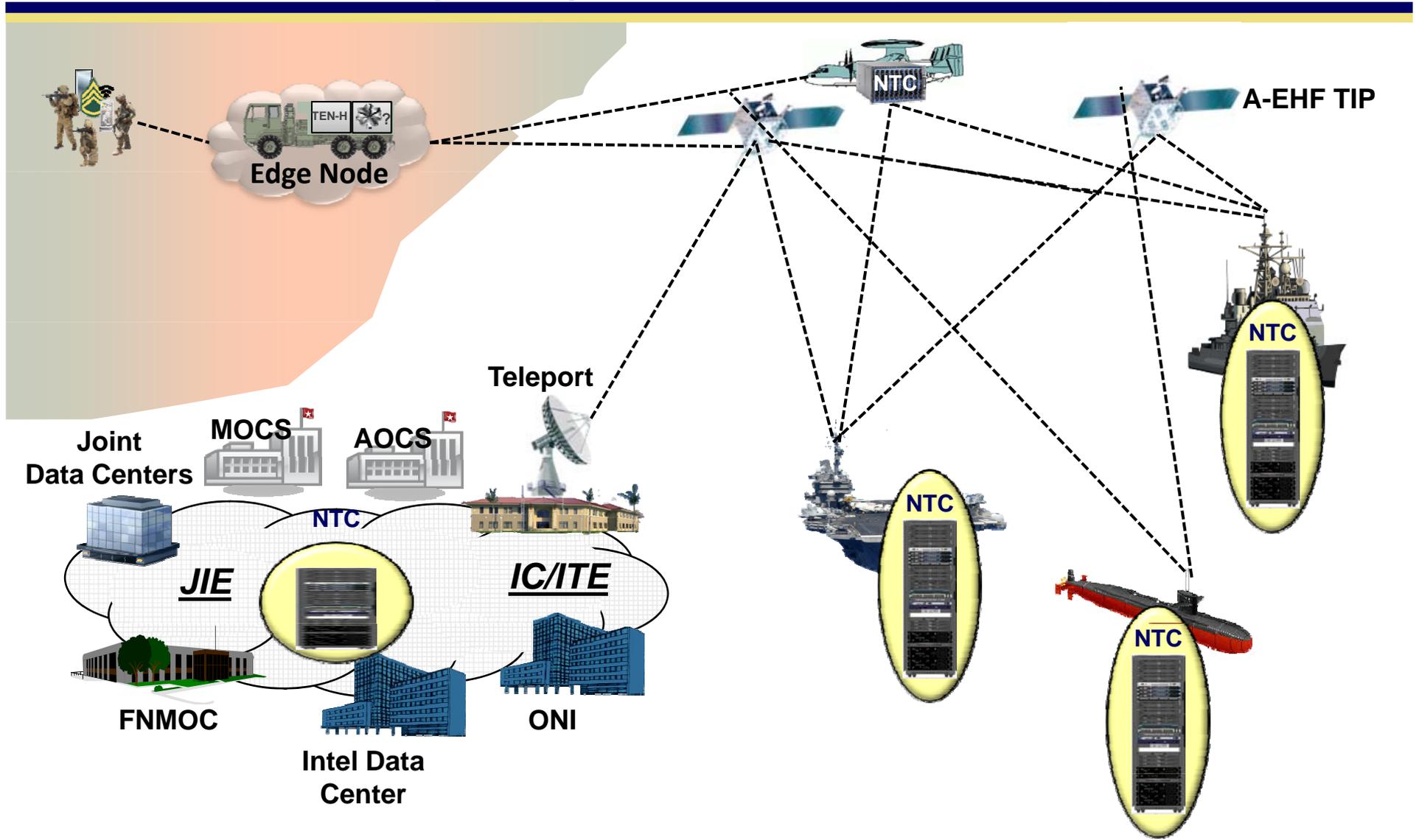
Naval Big & Semantic Data Challenge



Data Science Methodology



NTC Enabling Tactical Joint Warfighting Data Interoperability



Seamless Warfighting Data Interoperability Ashore/Afloat

Part #3

Developing on the NTC Platform

What is NTC?

- **NTC is an implementation of a Big Data analytic cloud environment.**

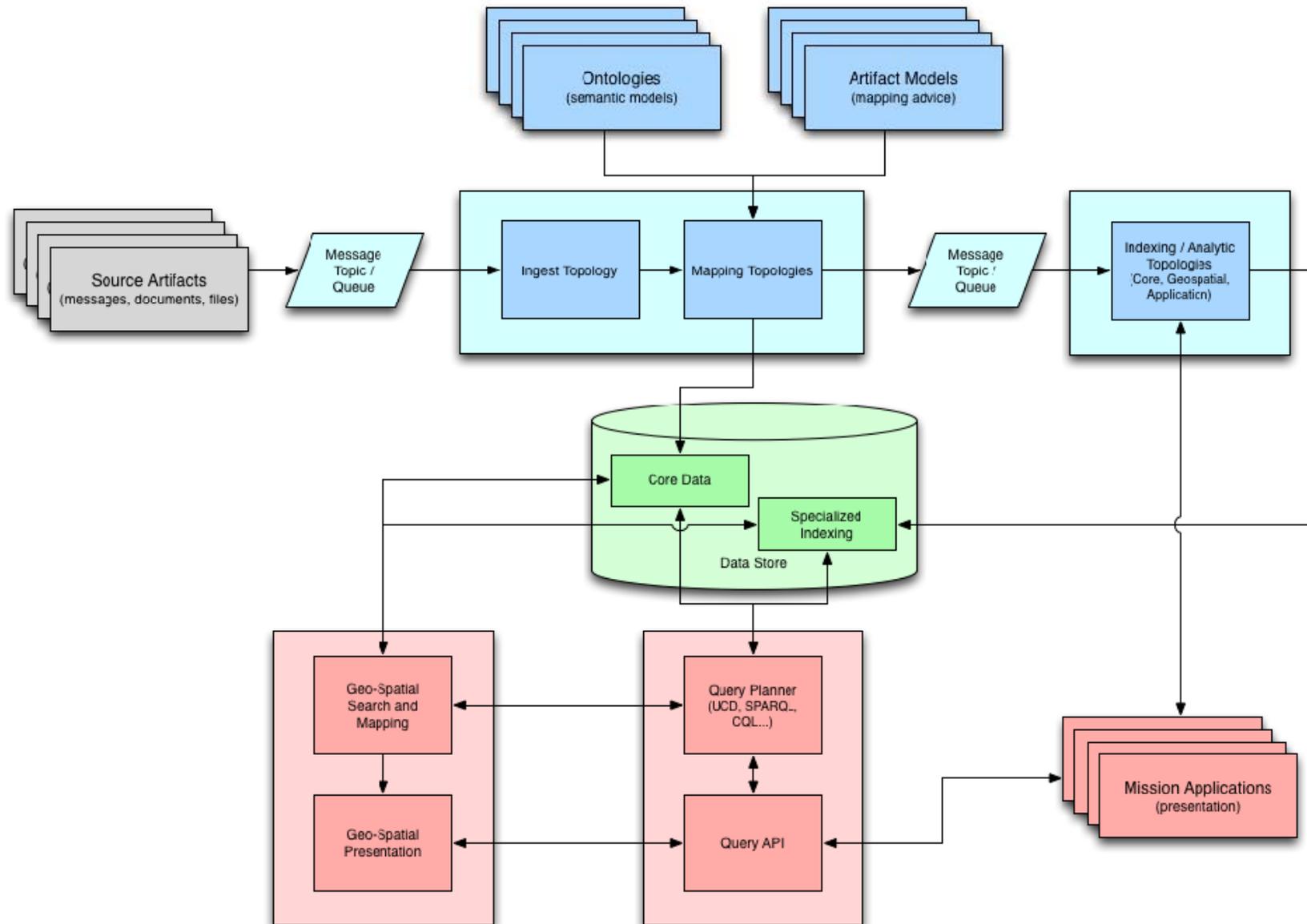
- “Cloud” is a heavily overloaded term. In this context, cloud is not about:
 - Offsite data storage, though remote storage and access to data may occur
 - Virtualization, though all or part of the architecture may be virtualized
 - Application hosting, though NTC will host and support client applications
- “Cloud” is about:
 - Providing the means to store and access massive amounts of data
 - Providing the means to host data from multiple disparate sources in a common environment
 - Providing the tools to extract meaning from and enrich data on a massive scale, including correlation of data from multiple domains

- **NTC is designed to operate at the tactical edge.**

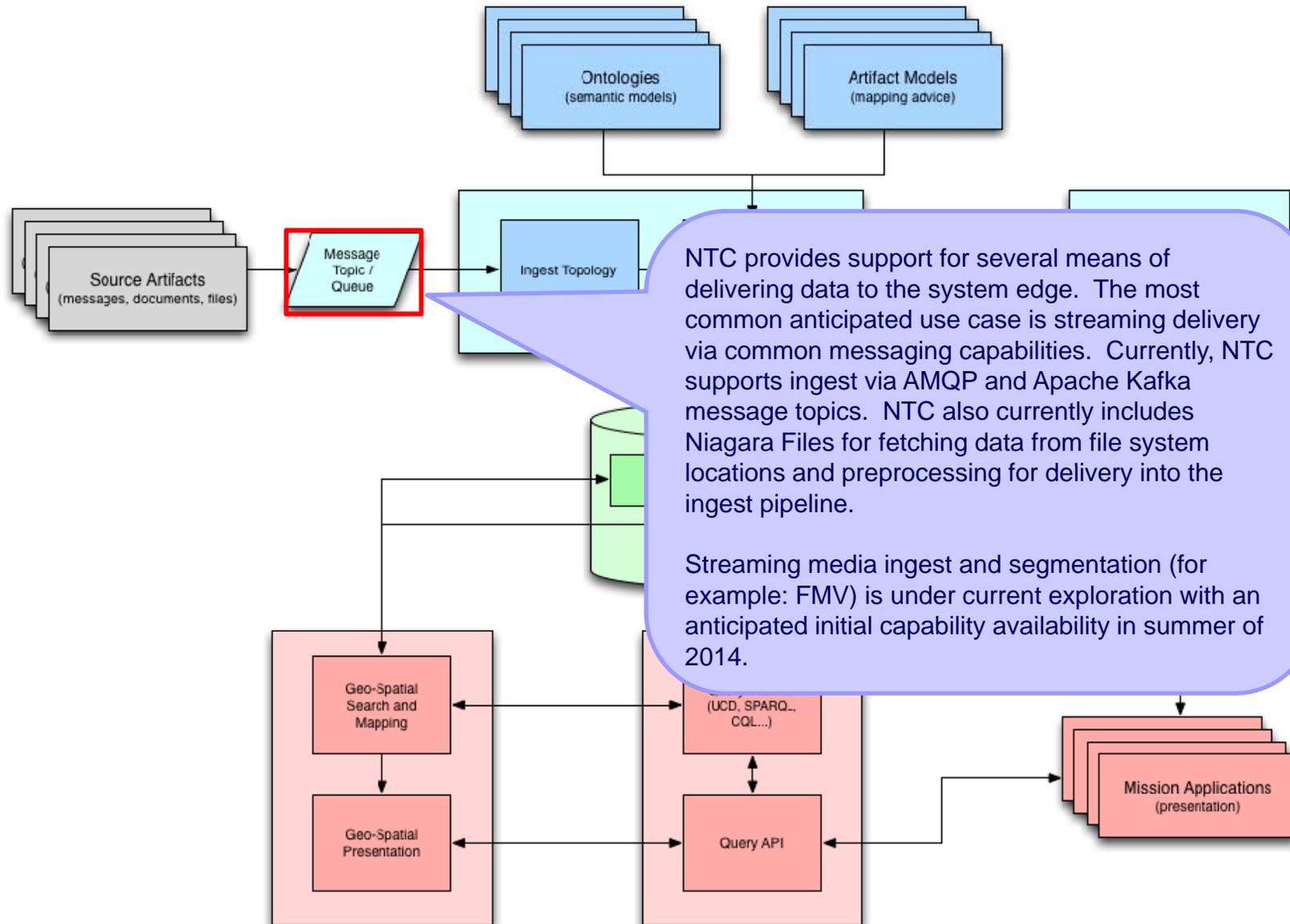
- NTC is intended to provide the means to take the tools that were previously available only to shore-based operators and at the national level , and to make them available to the forward-deployed warfighter
- NTC is designed to support data collection, analysis, and presentation capabilities, even in the absence of robust connectivity to resources ashore.

- **In Short: NTC is a set of services focused on providing an end-to-end ecosystem for ingesting, storing, processing, and accessing data from multiple and possibly disparate sources – in a package suitable for deployment to the tactical edge.**

NTC Ecosystem



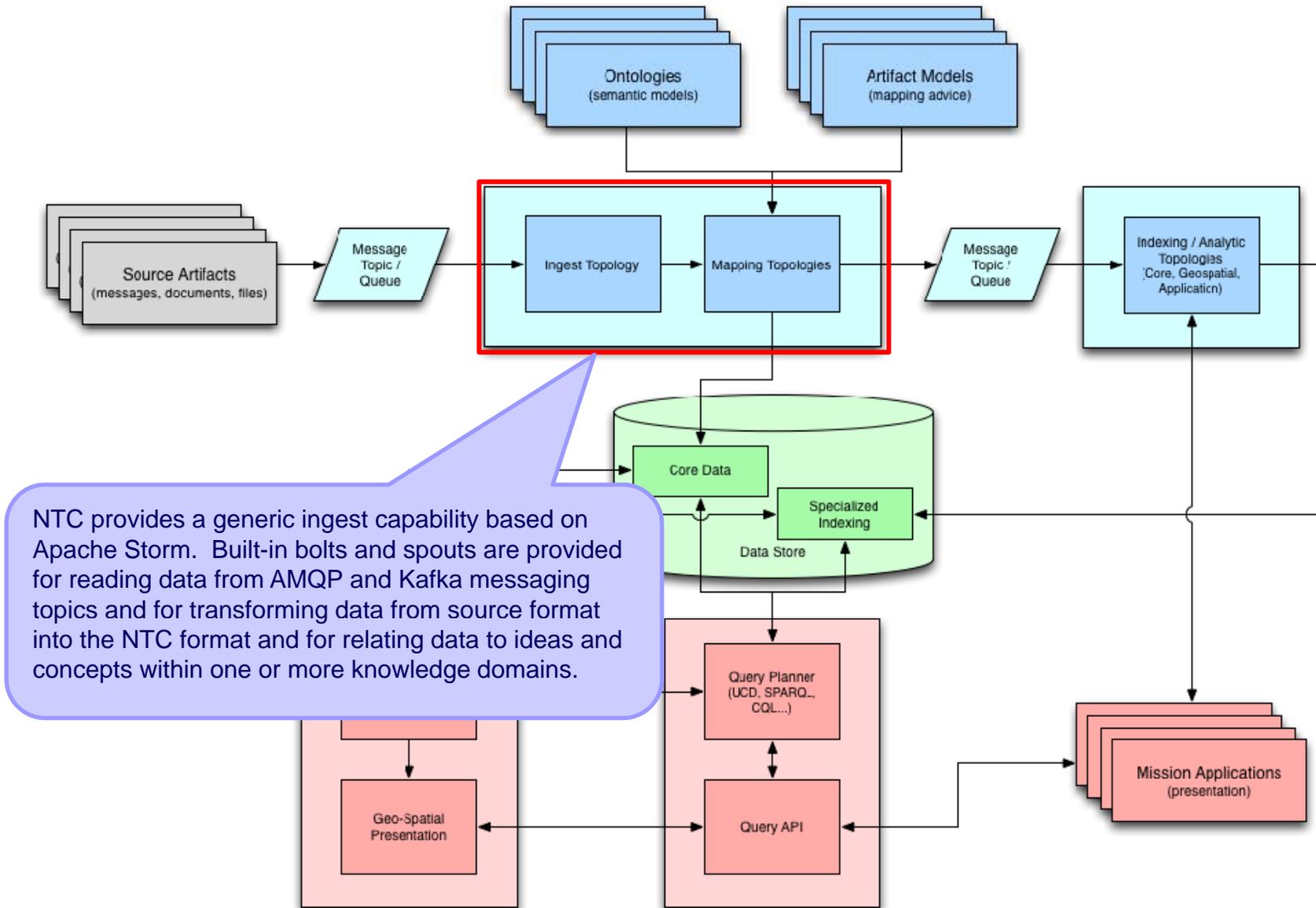
NTC Ecosystem



NTC provides support for several means of delivering data to the system edge. The most common anticipated use case is streaming delivery via common messaging capabilities. Currently, NTC supports ingest via AMQP and Apache Kafka message topics. NTC also currently includes Niagara Files for fetching data from file system locations and preprocessing for delivery into the ingest pipeline.

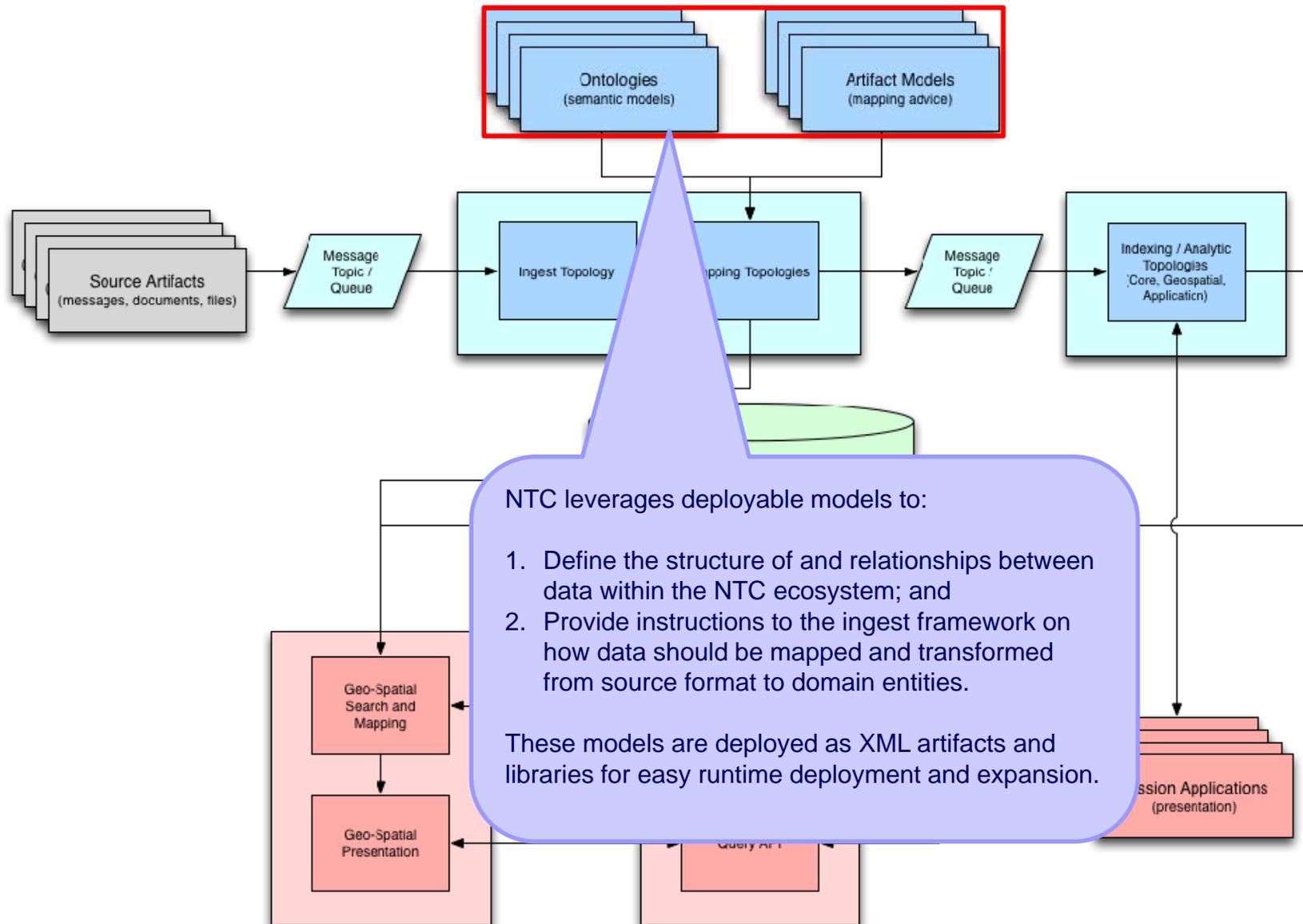
Streaming media ingest and segmentation (for example: FMV) is under current exploration with an anticipated initial capability availability in summer of 2014.

NTC Ecosystem

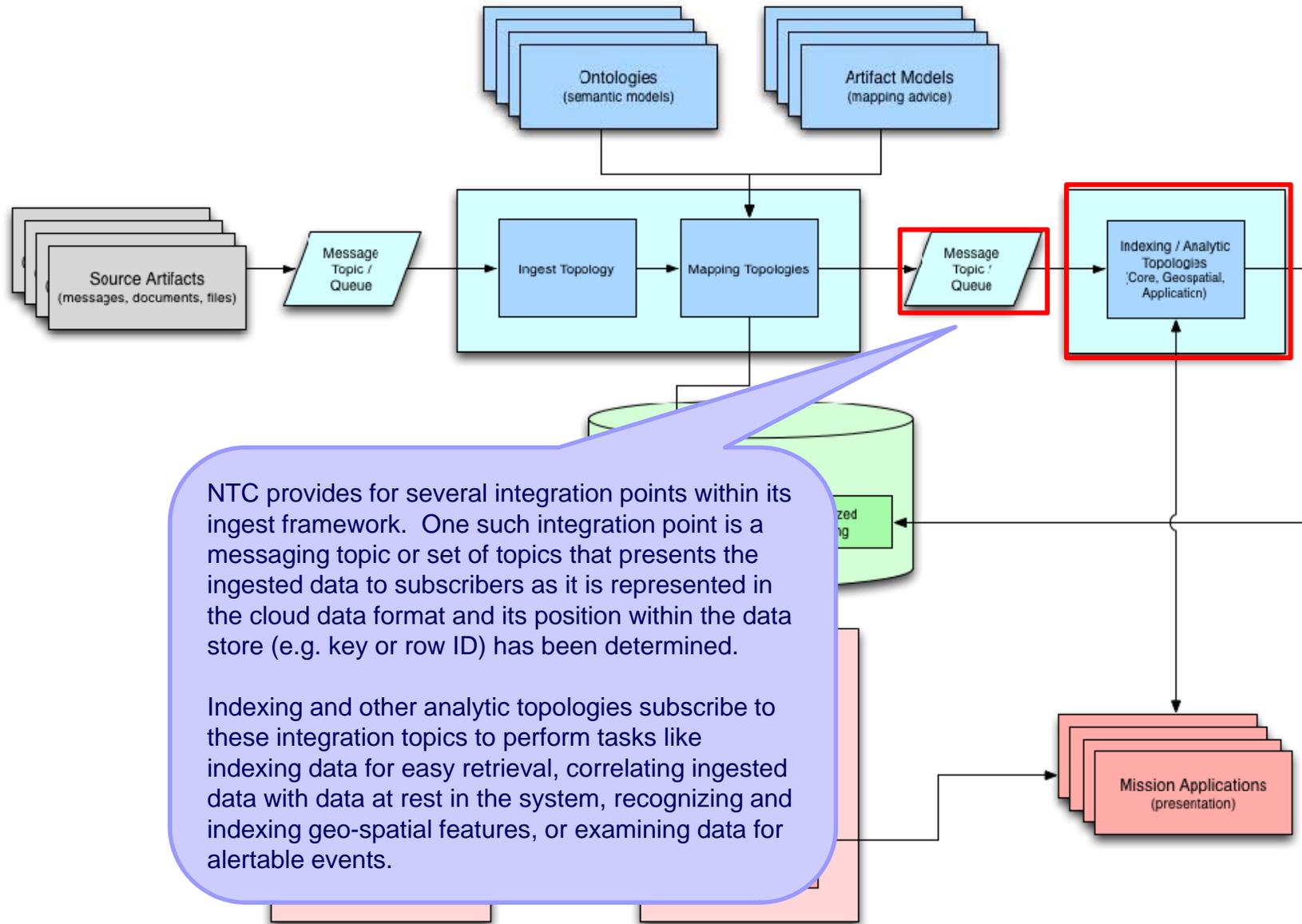


NTC provides a generic ingest capability based on Apache Storm. Built-in bolts and spouts are provided for reading data from AMQP and Kafka messaging topics and for transforming data from source format into the NTC format and for relating data to ideas and concepts within one or more knowledge domains.

NTC Ecosystem



NTC Ecosystem

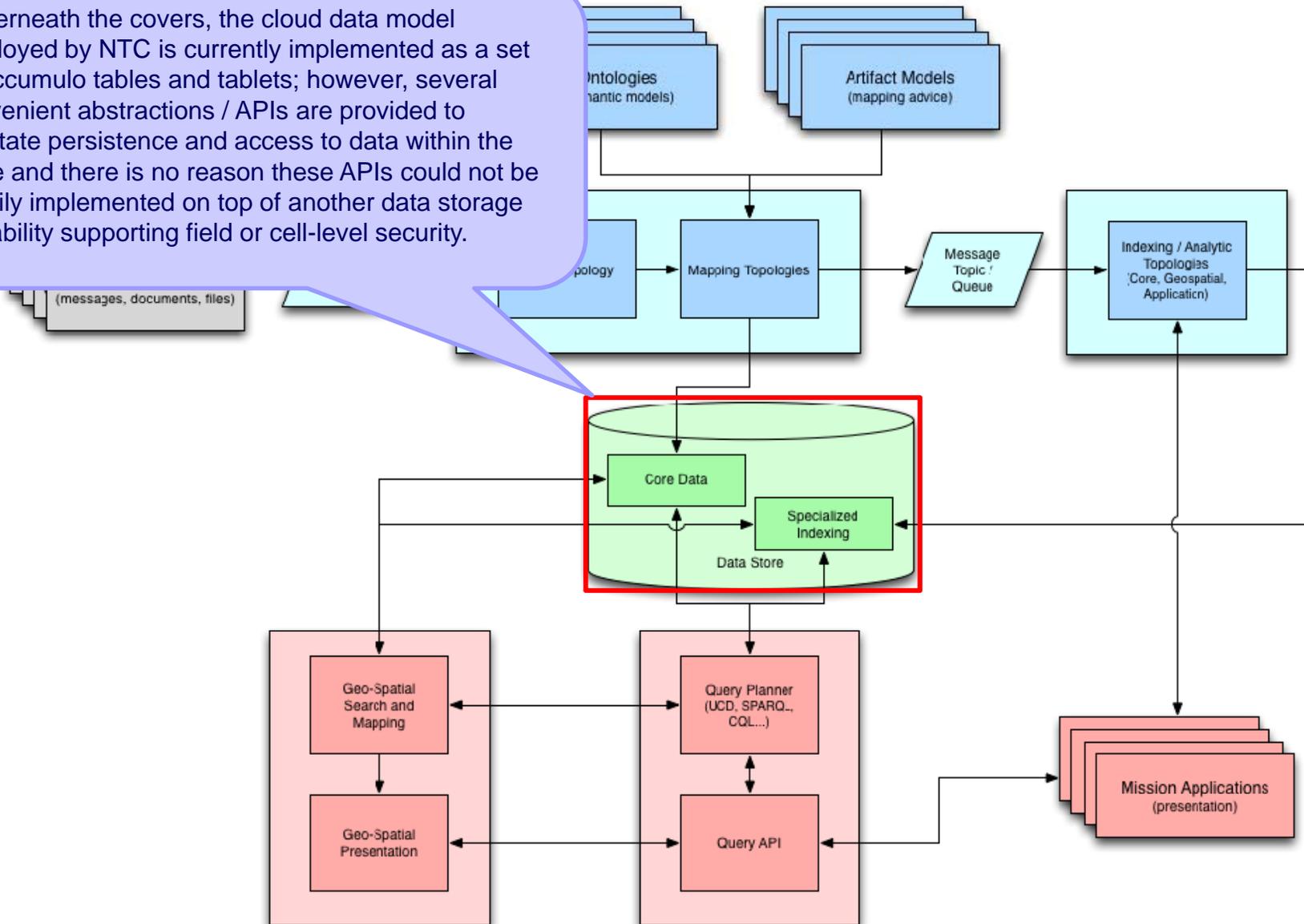


NTC provides for several integration points within its ingest framework. One such integration point is a messaging topic or set of topics that presents the ingested data to subscribers as it is represented in the cloud data format and its position within the data store (e.g. key or row ID) has been determined.

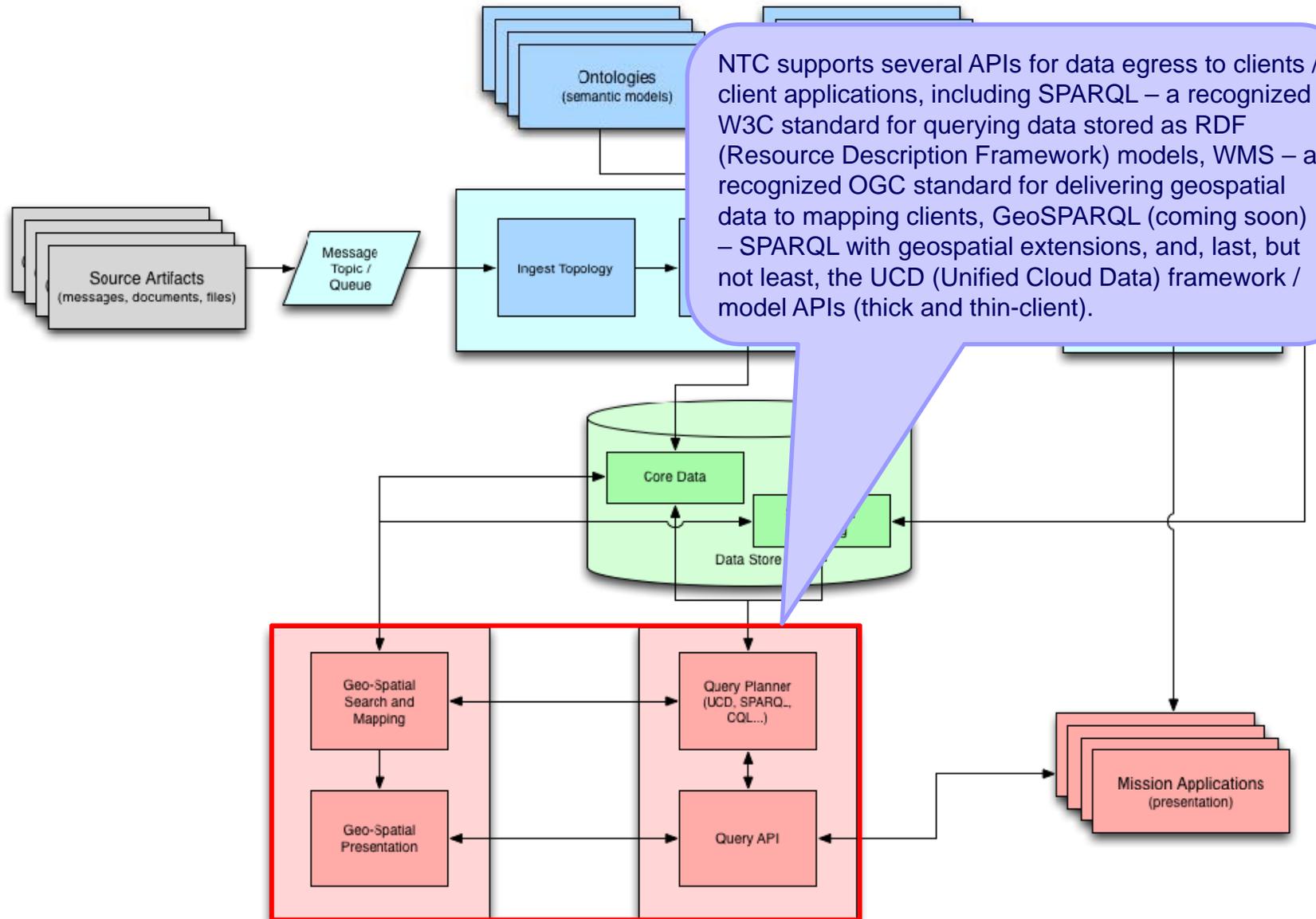
Indexing and other analytic topologies subscribe to these integration topics to perform tasks like indexing data for easy retrieval, correlating ingested data with data at rest in the system, recognizing and indexing geo-spatial features, or examining data for alertable events.

NTC Ecosystem

Underneath the covers, the cloud data model employed by NTC is currently implemented as a set of Accumulo tables and tablets; however, several convenient abstractions / APIs are provided to facilitate persistence and access to data within the store and there is no reason these APIs could not be readily implemented on top of another data storage capability supporting field or cell-level security.

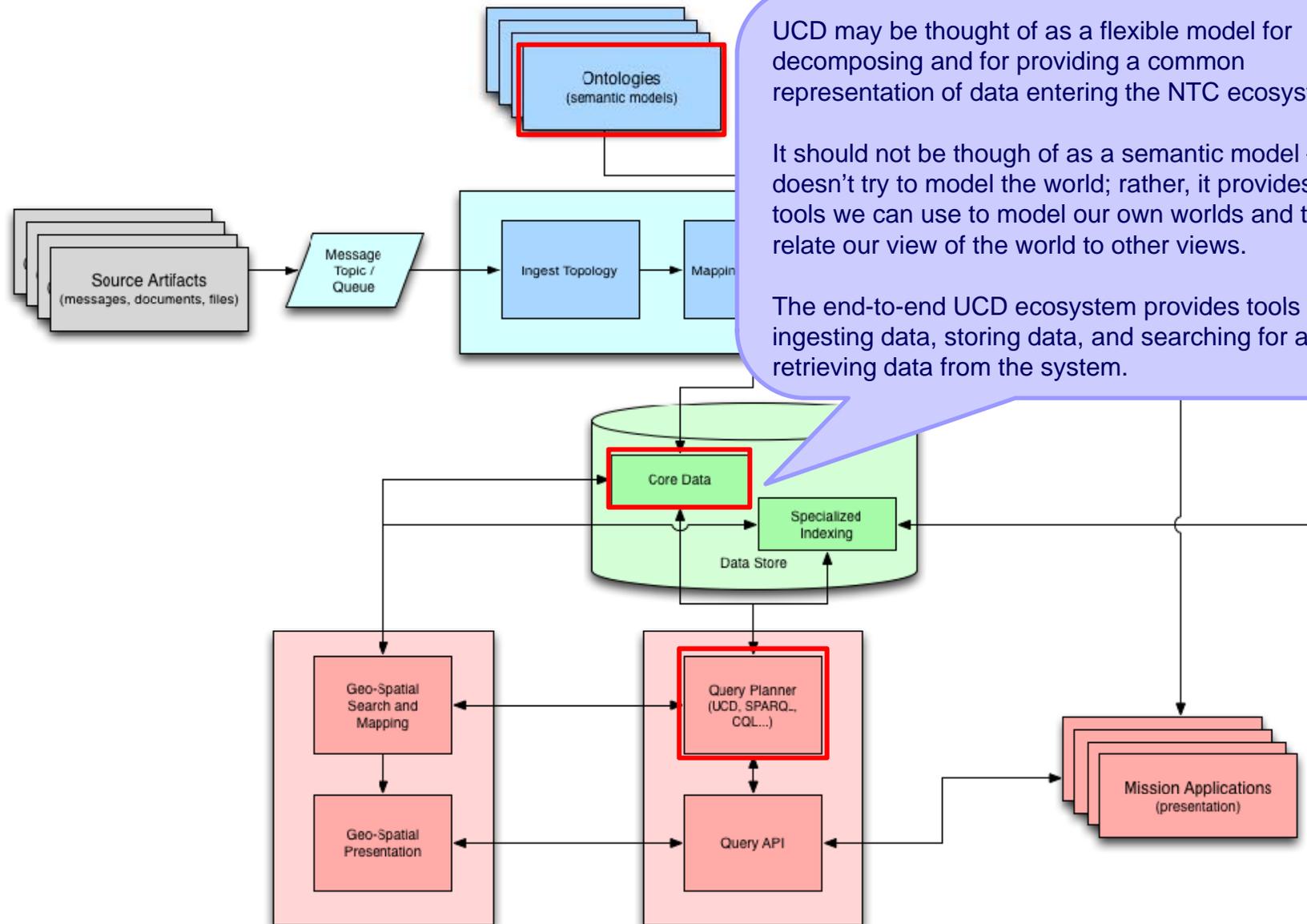


NTC Ecosystem



What is UCD?

How Does it Relate to NTC?



UCD may be thought of as a flexible model for decomposing and for providing a common representation of data entering the NTC ecosystem.

It should not be thought of as a semantic model – it doesn't try to model the world; rather, it provides the tools we can use to model our own worlds and to relate our view of the world to other views.

The end-to-end UCD ecosystem provides tools for ingesting data, storing data, and searching for and retrieving data from the system.

What is UCD?

How Does it Relate to NTC?

Modeling Data in UCD:

Semantic models are stored as data, rather than defined by structure: In UCD, models can be thought of as relational, but they are not defined by database, table, or column structure. Several tables / types within the UCD model are dedicated to definition of semantic models for describing data. These entities include *concepts*, *predicates*, and *related associations*. Within UCD, a *concept* can be thought of as a type definition. A concept represents an abstraction that can be applied across multiple items of concrete data. Examples of concepts might include things like *person*, *vehicle*, *truck*, *aircraft*, *building*, and so forth. Predicates represent verbs that may be applied to relate one instance of a concept to another, or, in the case of a model description, to relate one concept to another. Examples of predicates might include ideas like *has*, *knows*, *buys*, and so on. Predicates are binary: they take a subject argument and an object argument. Together the subject, predicate (verb), and object form a *statement*. An example of a concrete statement might be *John [subject] knows [predicate] Karl [object]*. An abstract statement defining a model relationship might go something like *car [subject] has [predicate] engine [object]*.

Common models and model elements promote universal understanding: If concepts or predicate meanings are duplicated within multiple models, the capability to relate data across multiple models or analytics is adversely impacted. This can be mitigated somewhat by relating model concepts themselves with a predicate (something like: *modelA|person: modelA|sameAs: modelB|person*), but at the cost of additional indirection within the data store, complicating queries and reducing performance. What is the significance of this? Model reuse may have a significant impact on performance and correctness. Fewer models means less indirection to get to the desired data. It also means less information that must be federated in order to promote understanding across platforms.

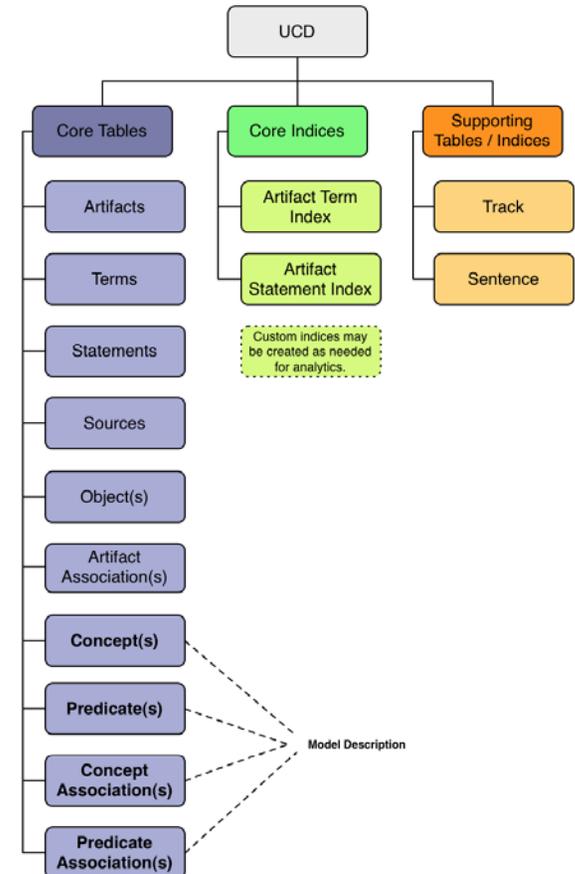
Artifacts may be thought of as source data (even if they are derived), terms and statements represent extraction / enrichment: What this means: Terms and statements can have meaning apart from the context of an artifact, but they may not be supportable without the source artifact. This raises the question of whether terms and statements should be federated apart from their source artifacts, or whether the source artifact should be federated whenever related extraction / enrichment products are moved. Since the meaning should be able to be derived from the extraction / enrichment products, it would make sense to federate them separately, unless the source artifact is explicitly requested, wouldn't it?

The intent of UCD is to promote data fusion by breaking data down into its smallest common denominators to promote sharing across applications and analytics: The concepts that serve to make the big-table big-data infrastructure useful across a broad range of applications include *extraction* and *enrichment*.

Extraction occurs when an inline or batch analytic breaks an *artifact* into its *terms*. An *artifact* represents some collection of data (typically one that has its own model outside the context of the cloud). An artifact may be a video clip (or metadata accompanying the clip), an XML message, a picture, a human-readable document, or other collection of data that is more complex than a single *term*. A *term* represents the smallest meaningful unit of data that may be extracted from an artifact. A term is defined by its name or identification (sign) within the artifact, association with the artifact (including location), and association with a (model) concept. A term might identify Jamie as a person, mentioned in Line 6 or 36 seconds into a given artifact.

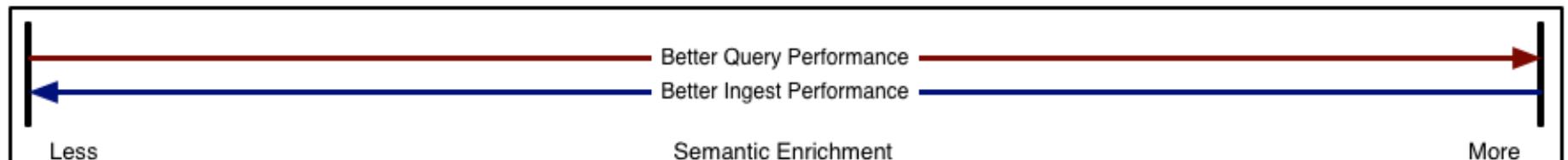
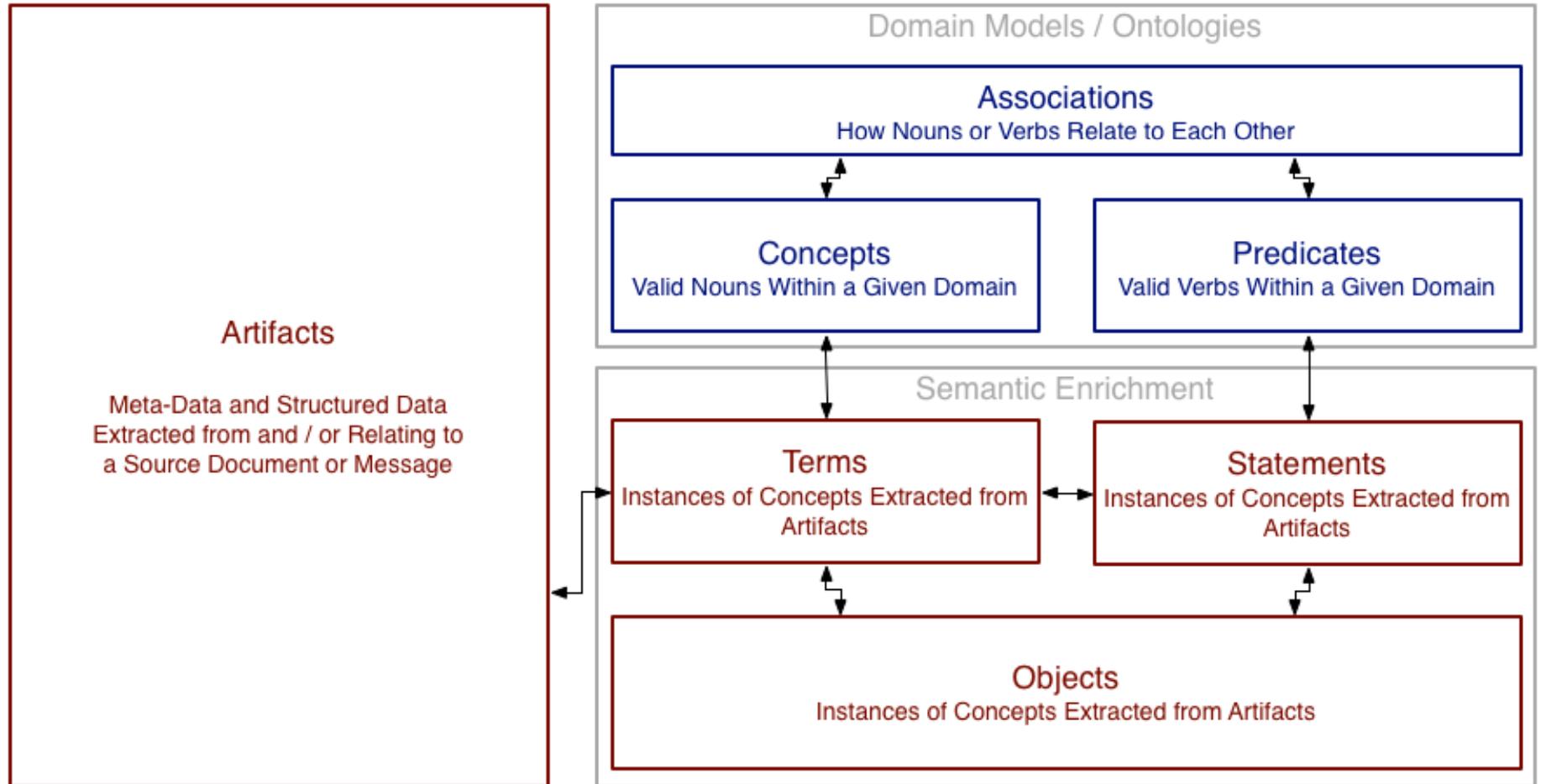
Enrichment occurs when an analytic creates assertions about data found in artifacts. These assertions are stored as statements and may be supported by sentences. An example of a statement might be "Karl buys cocaine," where the predicate *buys* references a valid verb in some known model (for example a model describing commerce). This statement has value in and of itself - all that is needed to preserve the information in the statement is the statement itself, including the terms, and the model explaining the terms' concept labels and the predicate (verb). A sentence entry may also be created to support the statement (the sentence may refer to a section of a video clip in which Karl is seen making his purchase).

Though Data Is Often Presented in Tabular Form, a Hierarchical View May Be a Better Approximation of Structure: In a BigTable application, the Row ID of an entry might better be thought of as a root ID of a tree. In tabular form the same row ID would be repeated for each column, or node in the tree. Hierarchical views of the UCD tables are presented below.



What is UCD?

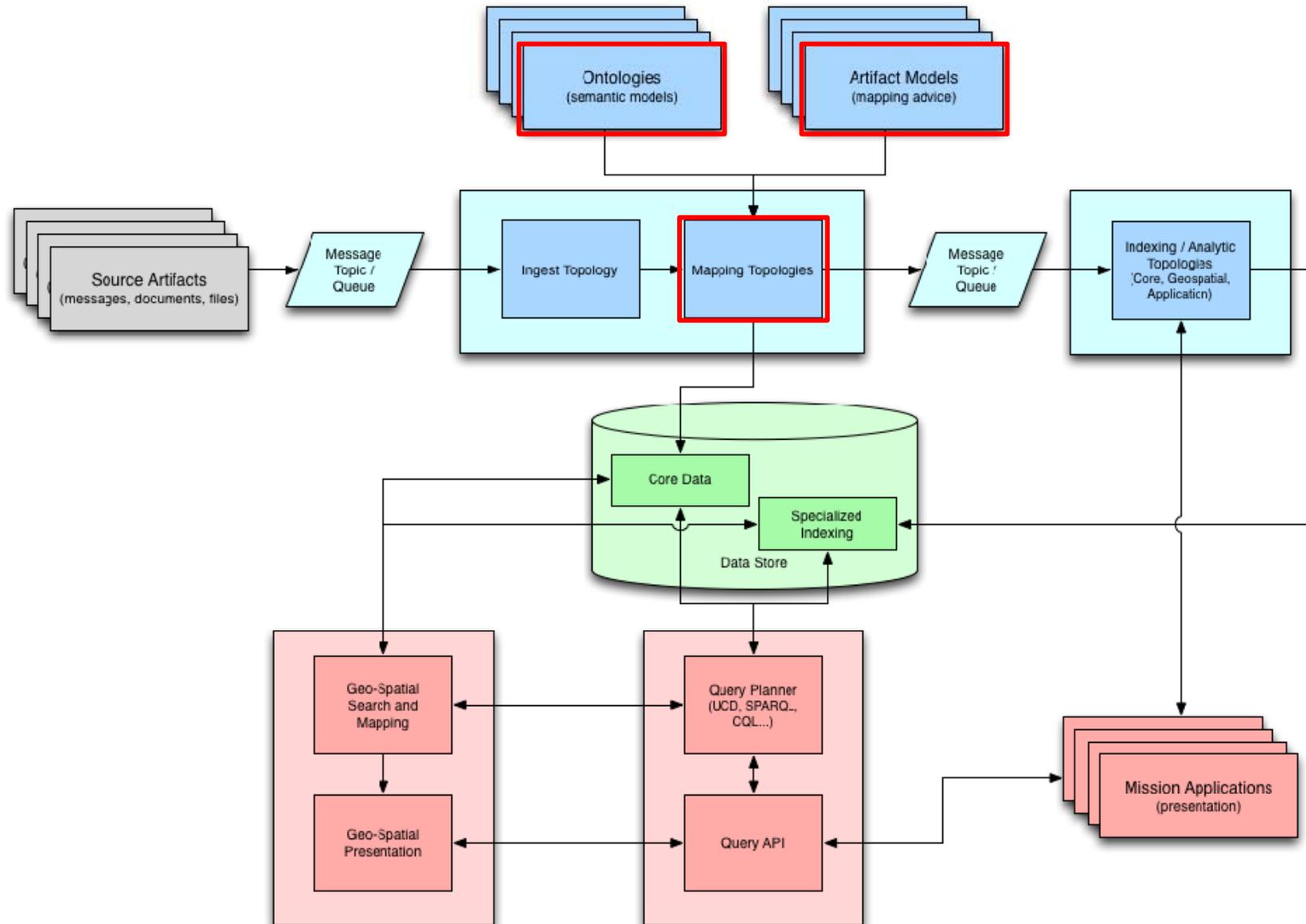
How Does it Relate to NTC?



Do I Have to Use the UCD APIs In Order to Use UCD?

- **No, NTC will provide several APIs to allow mission and other applications to interact with the data stored in the UCD store. In particular, the next release of NTC will provide limited support for ingest and retrieval of data in RDF formats. In particular:**
 - Ingest of TriG files
 - Retrieval of data via SPARQL / RDF query API
- **Because the underlying UCD structure provides support for representing data as SPO statements, the transition between UCD and RDF is a relatively natural one.**
- **As previously noted, NTCs geospatial components also provide support for retrieval of data by WMS-compliant clients.**

How Do I Ingest Data Into the UCD Ecosystem?



How Do I Map Data Into the UCD Ecosystem?

- **The DPF UCD Topology handles mapping of data from structured input documents to UCD entities**
- **The DPF UCD Topology provides a generic mediation and ingest capability for NTC**
 - The topology leverages models for instruction on mapping of data
 - New models may be added at runtime to add support for new input sources
 - Models are delivered in the form of XML documents and supporting libraries
- **There are two types of models used for ingesting data into the NTC UCD storage framework**
 - The Domain Model represents the “target” representation for the data being ingested
 - The Domain Model represents a knowledge domain and provides a standardized way of representing data from multiple sources within that domain (similar to an OWL model / ontology)
 - The Artifact Model provides the mapping instructions needed to extract and transform data from a source document or artifact and map it to concepts and structures described in one or more domain models

How Do I Map Data Into the UCD Ecosystem?

- **Do I have to map my source data to rich entities (graph topology)?**
 - In short, no. It is possible to map a message or document type to an Artifact only. In this case:
 - Artifact meta-data (things like author, source, dates) are mapped to the Artifact meta-data fields, as normal
 - Artifact data (content) are mapped to the Unstructured Text or Structured Data section of the Artifact
 - When would I want to map data to structured Artifact data?
 - When high-speed, high-volume ingest is essential (there are tradeoffs)
 - When semantic enrichment is non-essential or can be performed after the fact

Ingest Take-Aways

- **The Domain Model(s) represent(s) my target – how I want data represented within the system**
- **My domain models represent how I can query for and associate data within the system**
- **In order to be able to use my domain Concepts, I must register them with the system**
- **The Artifact Model represents my source to target mappings – how I get from the source representation to my domain model**
- **I can forego mapping to a domain model, but the penalty is a loss of richness in my data representation**
 - Limits the types of queries I can perform
 - Limits the types of associations I can draw

Development Process

- **Partners are participants – no “siloes” development**
 - NTC developers share common code repositories, common collaboration resources, and common development environments
 - NTC provides a partner forums and wiki resources for documentation and collaboration
 - NTC partners participate in NTC development planning and retrospective sessions
- **NTC is leveraging an agile development approach**
 - Sprints are planned at one-month intervals
 - Goals are established for all NTC developers (core and partner)
 - Daily stand-ups are conducted for each team
 - Retrospective and goal-setting occurs at the end of each sprint
 - Tasks are prioritized according to dependency and sponsor input
- **Bottom line: NTC is One Team, One Fight!**

Part #4

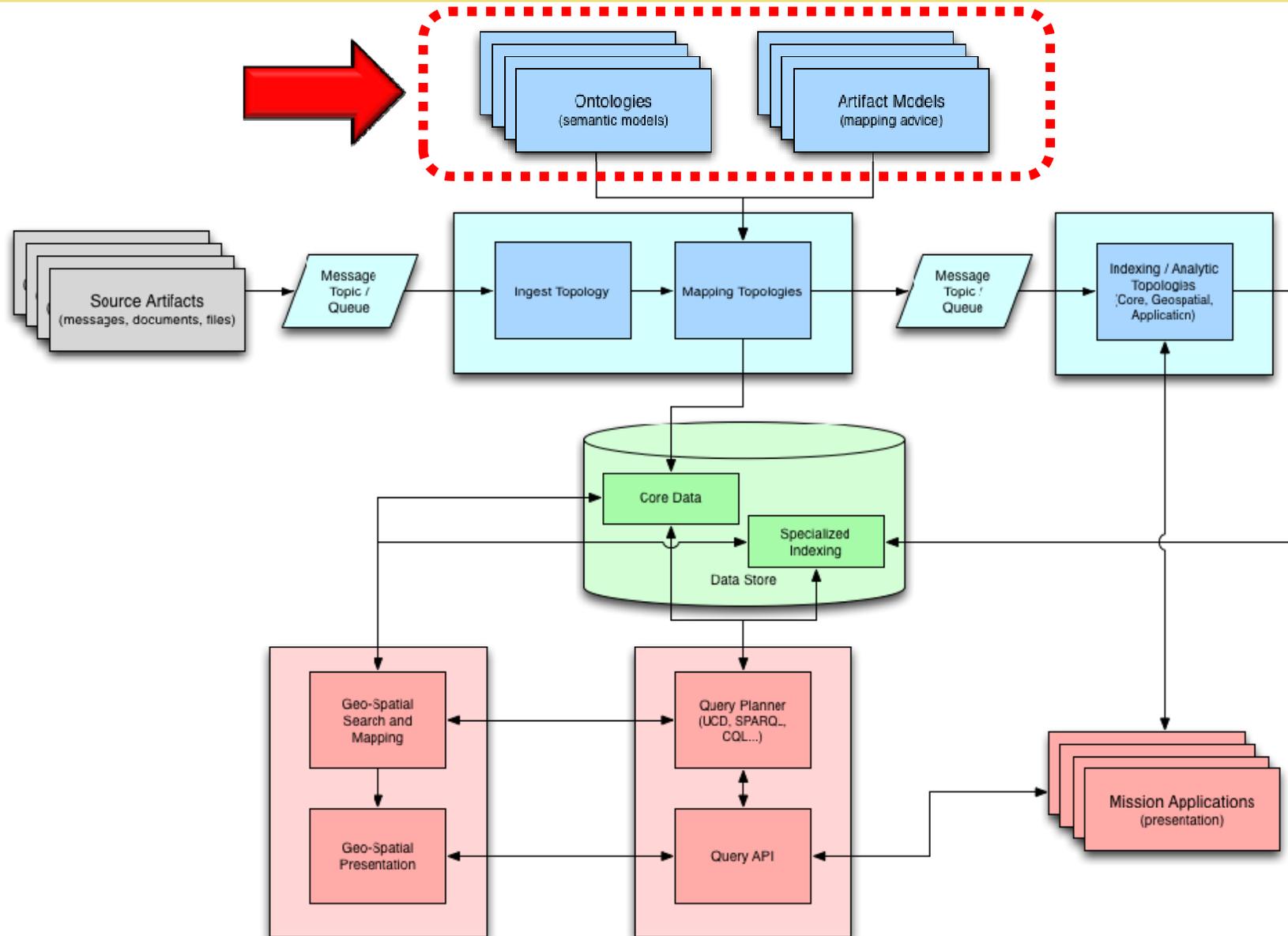
Data Science Thrust



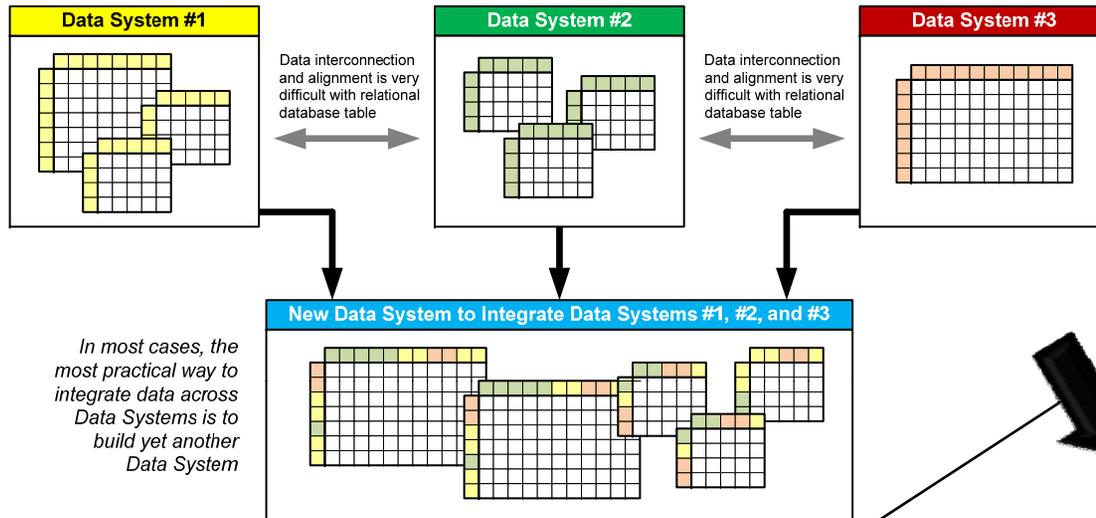
The Data Science Thrust

- **Purpose:**
 - Develop the Data Representations and Semantics to be used within the Naval Data Ecosystem
- **Provides the foundation for the entire DF-NTC EC**
- **Warfare Areas of Interest:**
 - ASW
 - IAMD
 - EXW
- **Key Supporting Domains of Interest:**
 - Combat ID
 - Spectrum Management
 - Cyber
 - Blue and Red Force Readiness
 - Blue and Red Force Structure and Capabilities
 - Plans & Tasks
 - Meteorological and Environment

Data Science Thrust in Context of the NTC Data Ecosystem



From Data Systems to Data Ecosystems



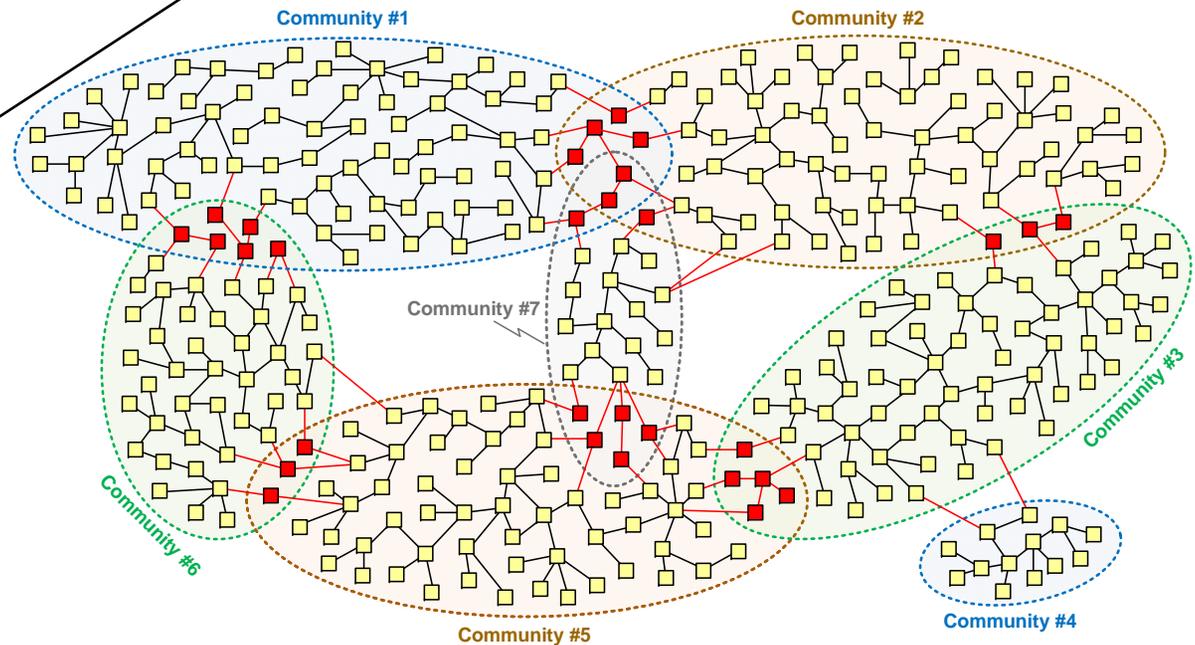
In most cases, the most practical way to integrate data across Data Systems is to build yet another Data System

Data Ecosystems:

- Optimized for flexibility and integration over performance and efficiency
- Interconnection and alignment of data is very easy

Data Systems:

- Optimized for performance and efficiency, over flexibility and integration
- Interconnection and alignment of data is very difficult



Objectives

- 1. Build Out families of Data Representations and Semantics required for modern Naval Warfare.**
- 2. Advance our ability to perform Data Representation and Semantic Mapping**
- 3. Develop Data Representations and Semantics that address challenges of A2AD/D-DIL Environments**



1. Build Out Families of Data Representations and Semantics for Naval Warfare

- **Goal is to develop a foundation that encompasses multiple Naval Mission areas**
 - Near-Term focus is on ASW, IAMD, and EXW
 - Cyber, EW, Spectrum Mgt. are considered key supporting areas
 - Long Term looking towards all Naval Mission Areas
- **Preferred Paradigm**
 - Artifacts → captured as is
 - Metadata → Graph representation (RDF)
 - Semantics → OWL/RDFS
 - Strong case must be made for other approaches
- **Leverage existing work being done by relevant COIs, don't start from scratch!!**
 - ASW COI → ASW COI Data Model
 - IAMD COI → Common Data Model
 - Others COIs → Joint, IC, Federal, Coalition (as relevant to Naval Warfare)



1. Build Out Families of Data Representations and Semantics for Naval Warfare (con't)

- **More interested in the actual Data Representation and Semantics, not the tools to produce and manage them**
- **Interested in techniques for generating OWL/RDFS Semantic definitions from other sources (e.g., UML)**
- **Looking for Data and Semantic Expertise relevant to the Naval Warfare domain**
 - More important to be Domain experts than to be RDF/RDFS/OWL experts
 - Compelling proposals will bring Domain expertise to the Table
- **High Productivity is Essential**
 - Current pace of building out Data Representations and Semantics is too slow
 - We are looking for proposals where more rapid progress is possible
 - Data Representations/Semantics built out in weeks/months, not in years



2. Advance our ability to perform Data Representation/Semantic Mapping

- **We expect the NTC Data Ecosystem to host many different Data Representations and Semantics from different Naval COIs**
 - COIs have made significant investments that can change quickly
 - COIs have unique Data Representation needs
- **For DF-NTC we want to be able to effectively map between the Data Representations and Semantics of different COIs**
 - Map Data Representations between COIs (both logical and physical)
 - Map Semantics to Data Representations
 - Map Semantics between COIs
- **Interested in Domain Expertise to Generate Mappings**
 - Need mappings between primary COIs ASW, IAMD, EXW
 - Need mappings to supporting domains: Cyber, EW, Spectrum Mgt., . . .
 - The mappings are of greater interest than tools to do mapping
- **Need to leverage commercial standards to express mappings**



3. Develop Data Representations and Semantics that address challenges of A2AD/D-DIL Environments

- **How to account for Data Representation and Semantic information that is distributed over a Tactical Force?**
 - How to deal with Identity
 - How to deal with Provenance
 - How to deal with Metadata generation and management
- **How do we adjust Data Representation and Semantic information to deal with resource constraints?**
 - Constraints on network bandwidth
 - Constraints on storage (onboard ship)
- **Can we use variable resolution Data Representation to mitigate A2AD/D-DIL conditions?**
 - Multiple Representations of variable size
- **How do we support real-time mapping between COI Data Representations and Semantics in A2AD/D-DIL conditions when distributed across a Battle Group?**

Summary of Key Challenges

- **How can we speed up the creation of data representation and ontology designs from taking years to taking weeks or months?**
- **How do we avoid the proliferation of too many specialized data representations and ontologies such that it becomes too hard to manage them and integrate them?**
- **How can we automate the capture and ingestion of legacy data representations and ontologies into RDF/OWL?**
- **How can we automate the cross-connection of different data representations and ontologies from across diverse communities?**
- **What are the key data representations and ontology constructs for addressing Cross Warfare Area planning and resource allocation activities**

Departing Thoughts

- **It isn't necessary to address the full breadth of all Naval Warfare Areas, but . . .**
 - Be sure to address a sufficiently substantial subset
 - Be sure and be able to fully address the scope of your selected subset
- **Recognize the Data Science Thrust will support other Thrusts**
 - Show how you can be sufficiently flexible to support needs of other Thrusts
- **Leveraging Data Representations/Semantics from other Naval Communities is essential**
 - Proposing to build from scratch will be looked at with much skepticism

Part #5

Data Ingest & Indexing Thrust



Data Ingest & Indexing Thrust

- 1. Build a rich set of data within the Naval Tactical Cloud Big Data environment that will support the development of advanced analytics for ASW and IAMD**
- 2. Develop enhancements and augmentations to the current Naval Tactical Cloud that facilitate faster and easier data ingest and indexing**

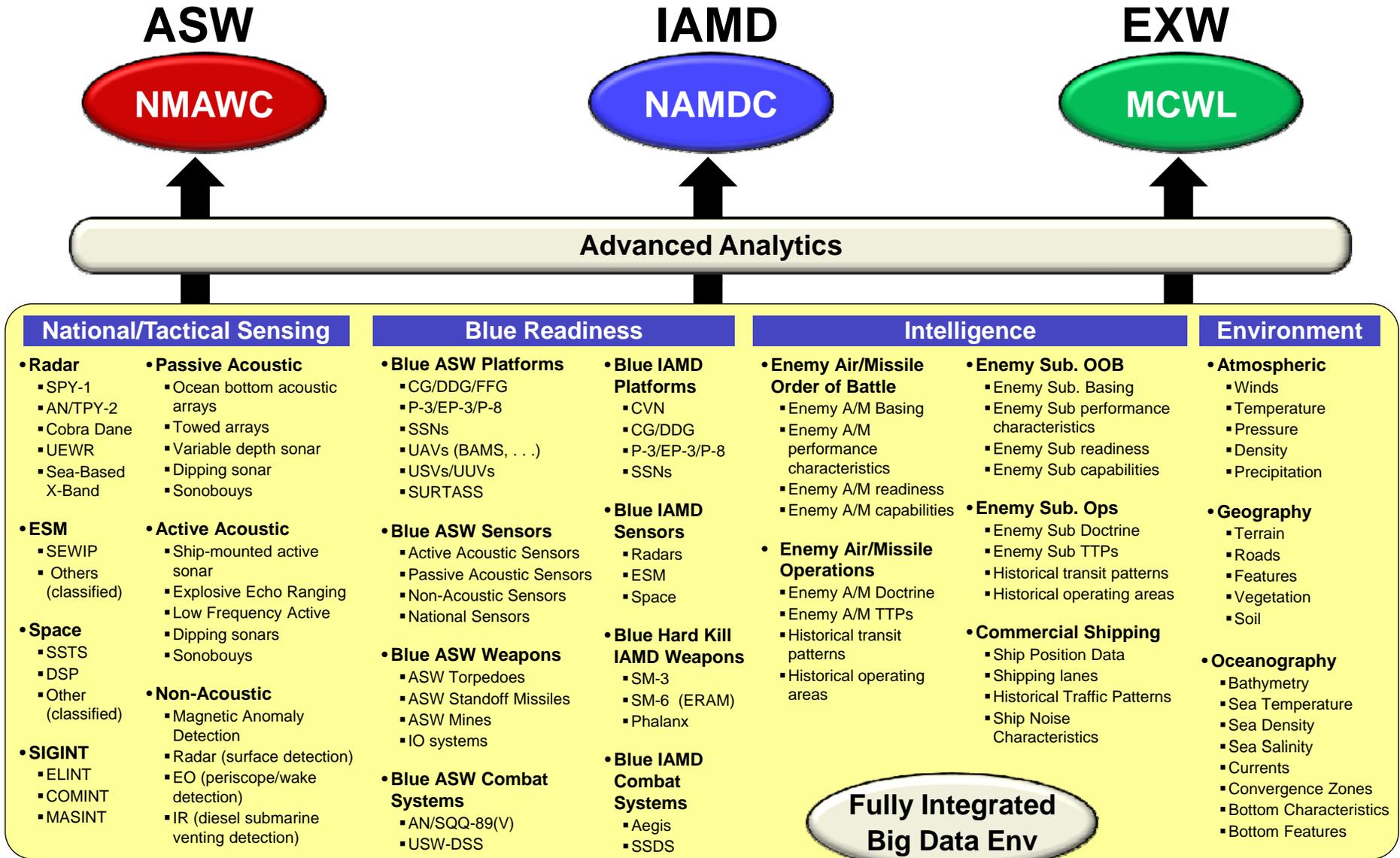


1. Build a Rich Set of Data within the NTC

- **Developing comprehensive Big Data sets for Naval Warfare has been a challenge**
 - Interested in all Naval Mission Areas
 - ASW, IAMD, and EXW are the primary focus areas for the BAA
 - Cyber, EW, Spectrum Mgt. are considered key supporting areas
- **Goal is to develop robust Big Data sets for Naval Warfare**
 - Data Sets directly relevant to ASW and IAMD
 - Big Data sets that support ASW and IAMD
- **Looking for teams with Domain (e.g., Data) expertise**
 - We expect all proposers to have experience with Big Data technology
 - Need to show you understand the data, not just the technology
 - Many Naval data sets are highly classified, so must have proper clearances
- **Looking for ideas for getting up the Data Curve**
 - We are looking for 90% coverage of relevant data, not 10%
 - We are looking for how to bring in real data, from Naval Mission partners

Data Scope

(Examples, not Prescriptive)





2. Develop enhancements and augmentations to the current Naval Tactical Cloud that facilitate faster and easier data ingest and indexing

- **Goal is to ingest and index faster and more effectively**
 - Interested to enhancements to existing NTC ingest and indexing processes
 - Must show how enhancements will result in actual data getting into NTC
- **For Data Ingest**
 - Primary goal is bringing content into the Naval Data Ecosystem
 - Interested Data Sets directly relevant to ASW and IAMD
 - Interested in relevant supporting data sets (Cyber, EW, Spectrum Mgt.)
 - Interested in enhancements that result in more data ingest production
- **For Data Indexing**
 - Most interested in ideas for general indexing (i.e., indexing for unanticipated use cases, not specific use cases)
 - Interested in indexing for distributed, federated environments (e.g., a Battle Group)
 - Interested in indexing that is robust in A2AD/D-DIL conditions
 - Interested in indexing under constrained storage conditions

Other Considerations

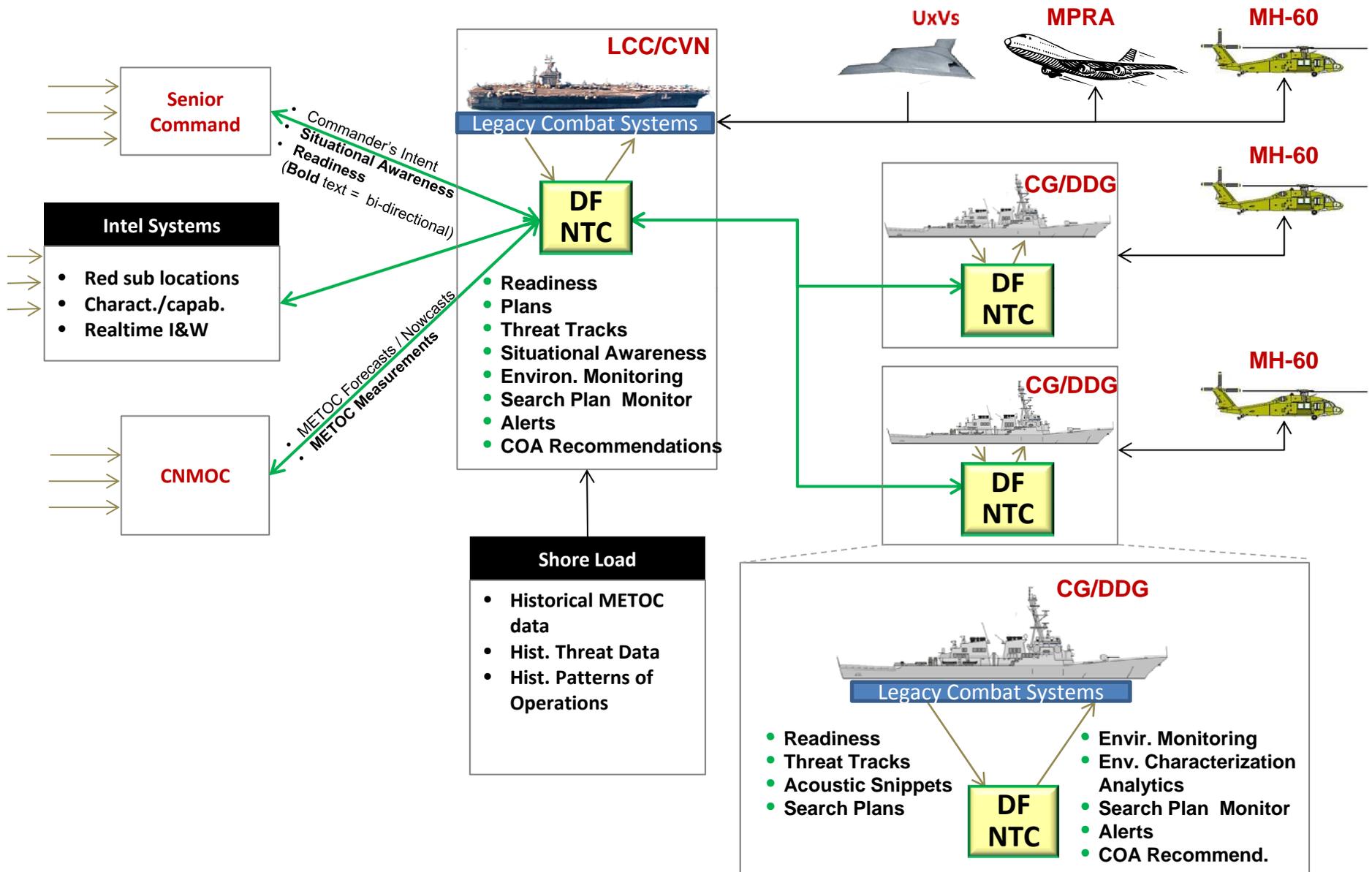
- **Experience with NTC-like Big Data platform is important**
- **Domain Expertise (e.g., understanding the data) is essential**
- **Key emphasis is ability to ingest and index real data**

Part #6

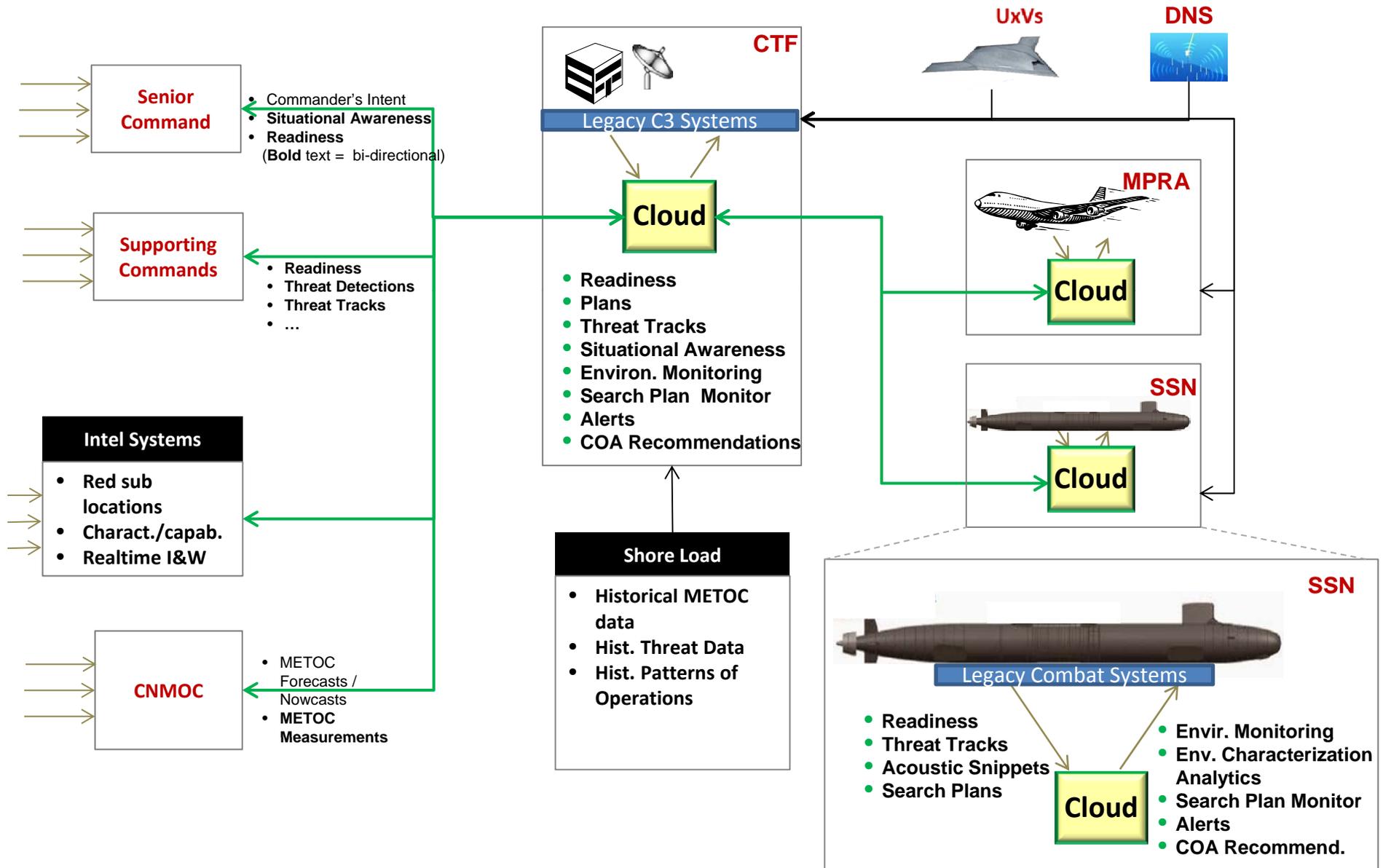
Analytic Thrust / ASW

- **Two ASW scenarios cases will be introduced to offer context.**
- **Three exemplars will be briefed:**
 - “Mundane” – Ambient Noise
 - Monitoring
 - Analyzing
 - Data sharing
 - Forecasting
 - Alarm triggers
 - “Intermediate” – Acoustic snippet fusion
 - Analyzing
 - Discovery
 - Fusion
 - Bell-ringing
 - “Reach” – Multi-domain info-fusion
 - Prioritized Discovery
 - Multi-domain fusion
 - Situational Awareness / Commanders Intent
 - Decision-making

ASW Scenario – Strike Group Use Case



ASW Scenario – Theater ASW Use Case



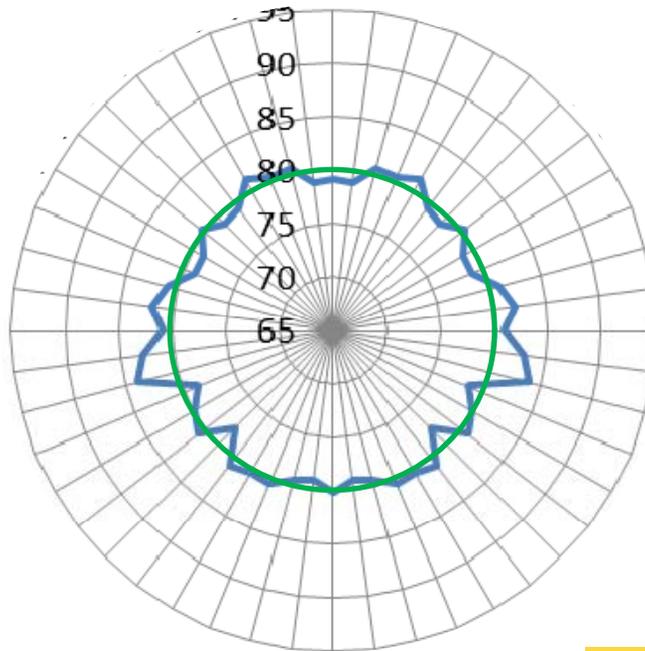
Mundane Exemplar of Cloud Analytic in Support of ASW

Ambient Noise Monitoring Analytic

- **A series of 5-minute ambient noise measurement have been modeled.**
 - Temporal variability
 - Beam-to-beam variability
- **A four hour sequence of “measured” noise is depicted.**
 - In our exemplar, 80 dB is assumed to be the historical omni-directional (isotropic) noise field.
 - This is what the platform and the ASW Commander would use in planning.
 - For ease of understanding, representations of ambient noise are based on omni-directional noise, such that noise level in the beam is adjusted to reflect what an isotropic noise field would have produced it.
- **The last slide:**
 - Shows 24 hours of simulated data.
 - Shows what a noise monitoring analytic might do.
 - Suggests additional mundane cloud analytics that might be brought to bear

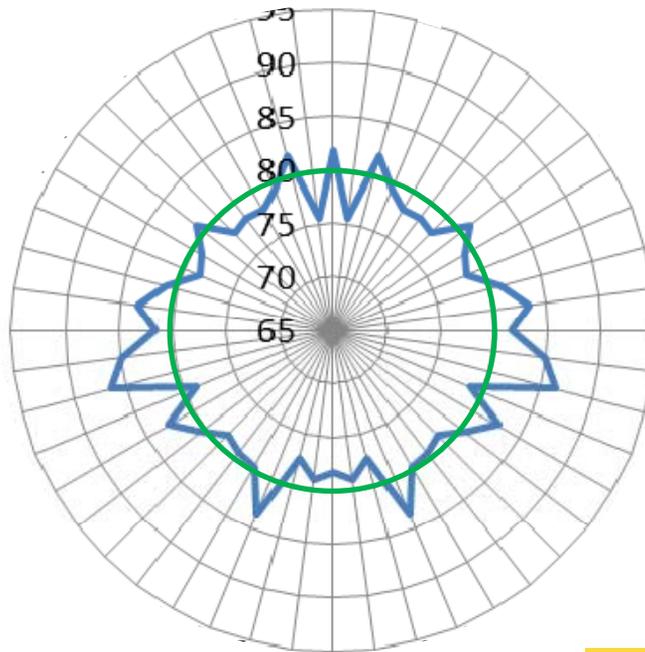
Today, there is a lot of reliance on historical data for planning and then Situational Awareness

T=0 Hours



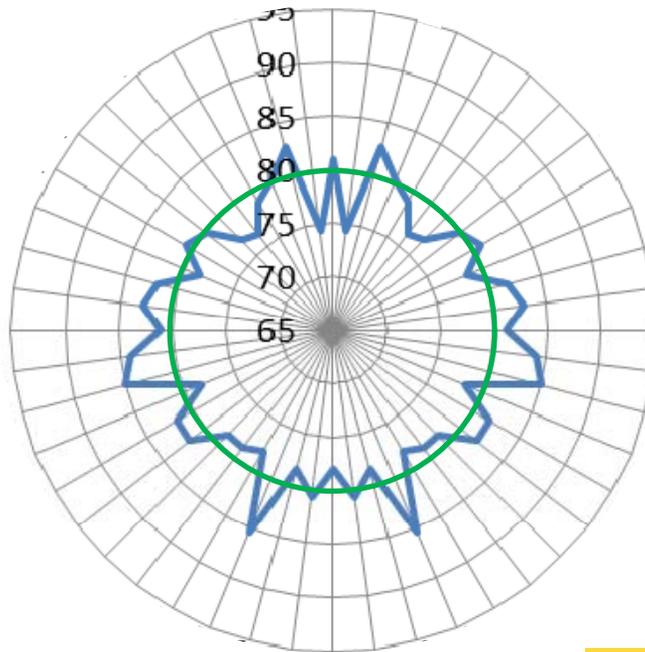
— Omni-noise as measured in the beam
— Historical omni-noise @ 80 dB

T=0.0833 Hours



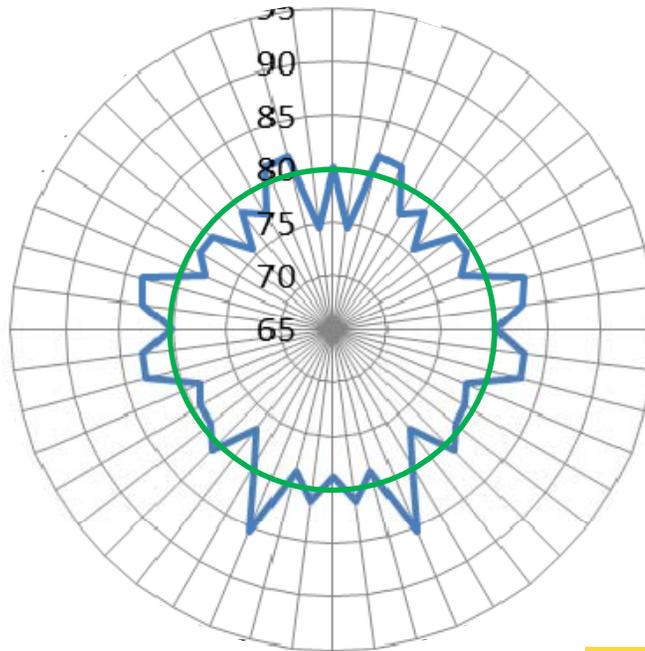
— Omni-noise as measured in the beam
— Historical omni-noise @ 80 dB

T=0.1666 Hours



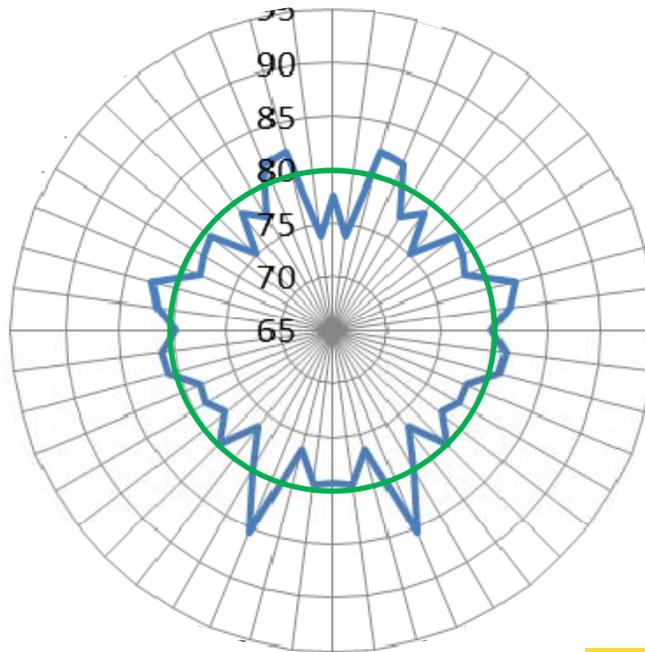
— Omni-noise as measured in the beam
— Historical omni-noise @ 80 dB

T=0.2499 Hours



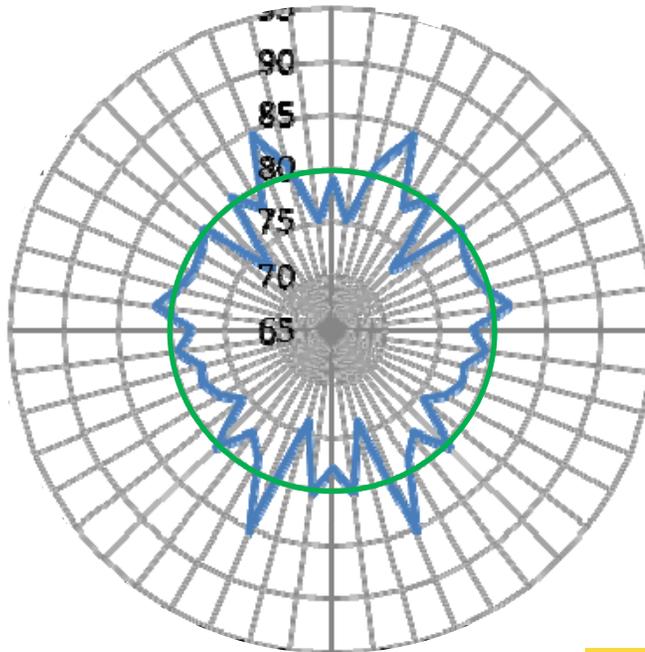
— Omni-noise as measured in the beam
— Historical omni-noise @ 80 dB

T=0.3332 Hours



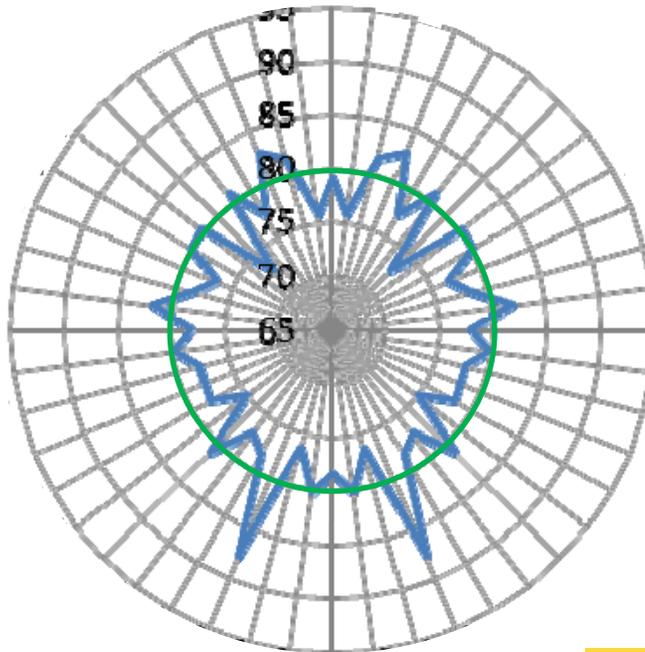
— Omni-noise as measured in the beam
— Historical omni-noise @ 80 dB

T=0.4165 Hours



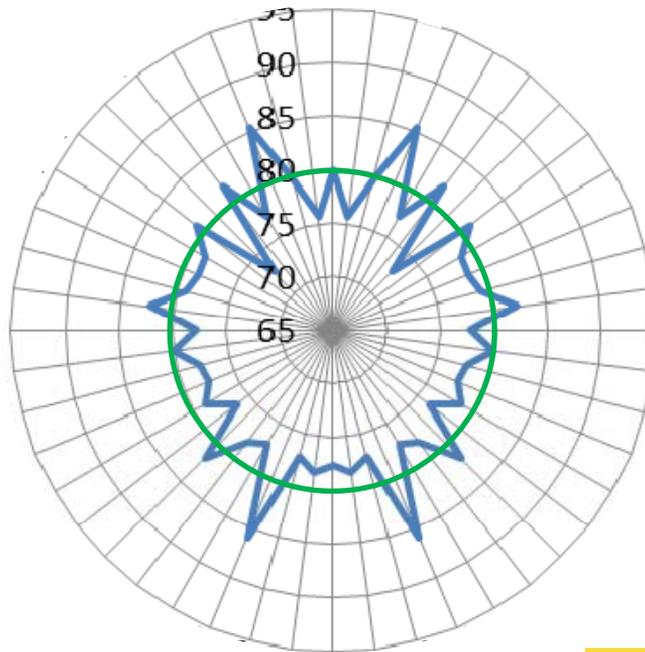
— Omni-noise as measured in the beam
— Historical omni-noise @ 80 dB

T=0.4998 Hours



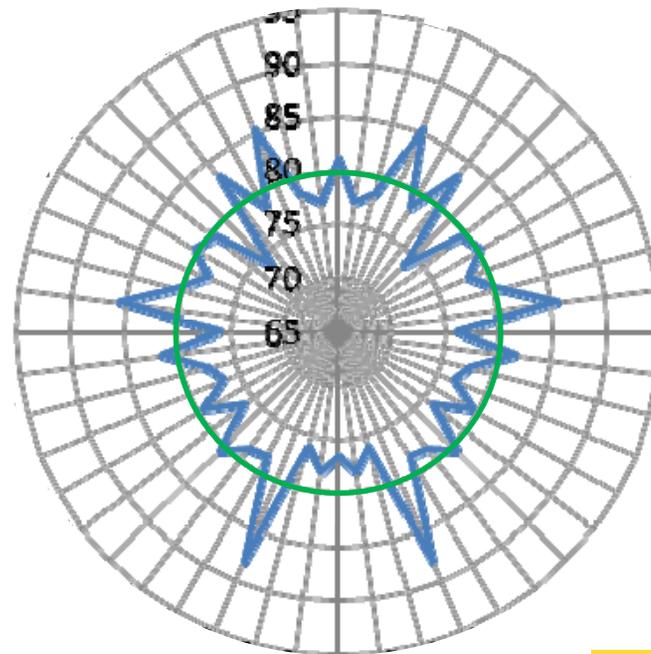
— Omni-noise as measured in the beam
— Historical omni-noise @ 80 dB

T=0.5831 Hours



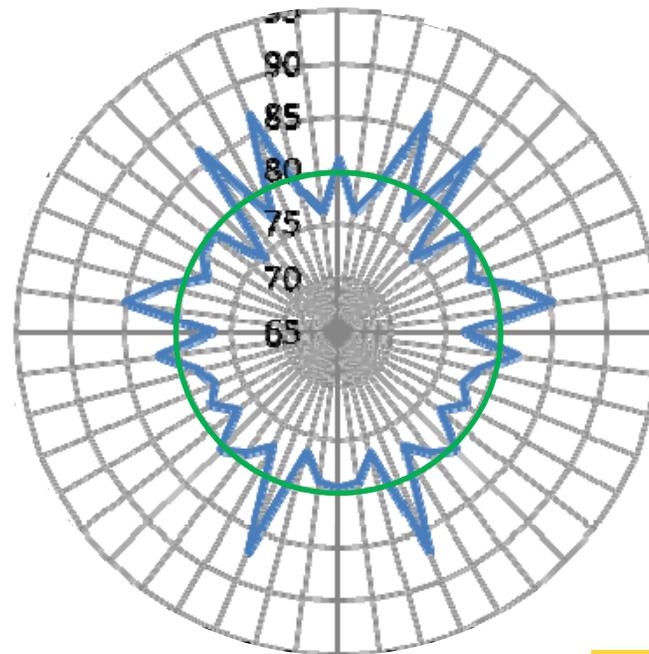
— Omni-noise as measured in the beam
— Historical omni-noise @ 80 dB

T=0.6664 Hours



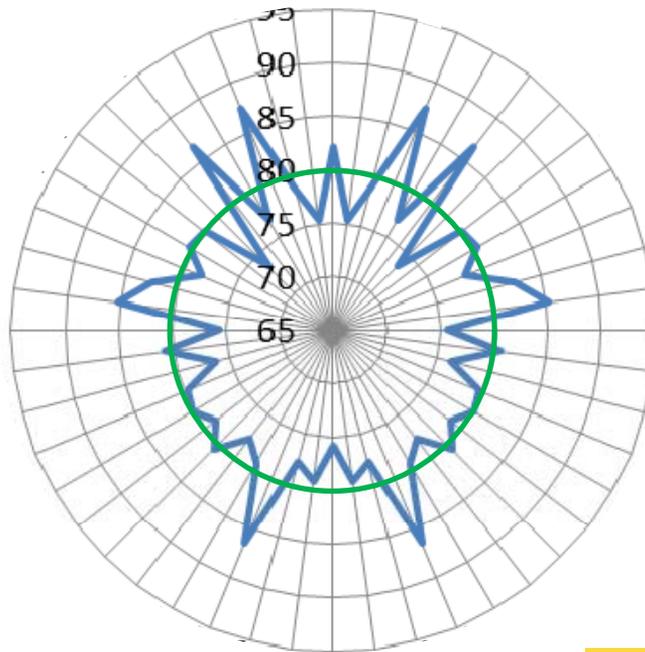
— Omni-noise as measured in the beam
— Historical omni-noise @ 80 dB

T=0.7497 Hours



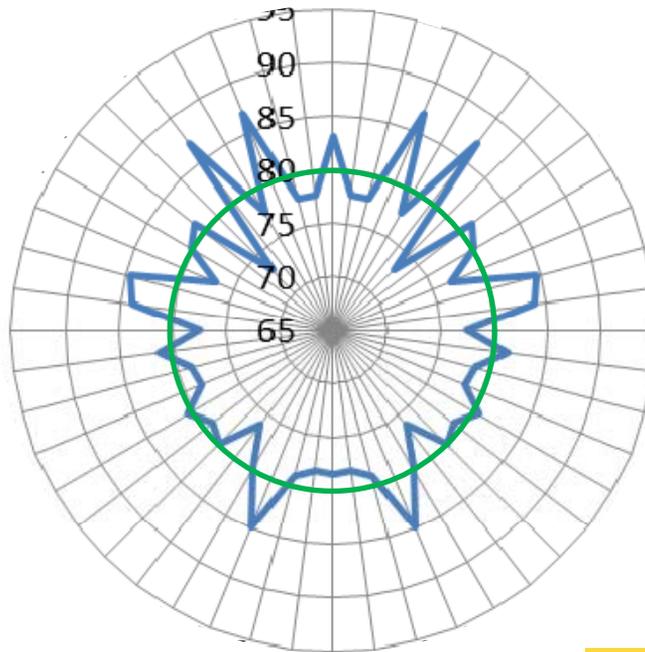
— Omni-noise as measured in the beam
— Historical omni-noise @ 80 dB

T=0.833 Hours



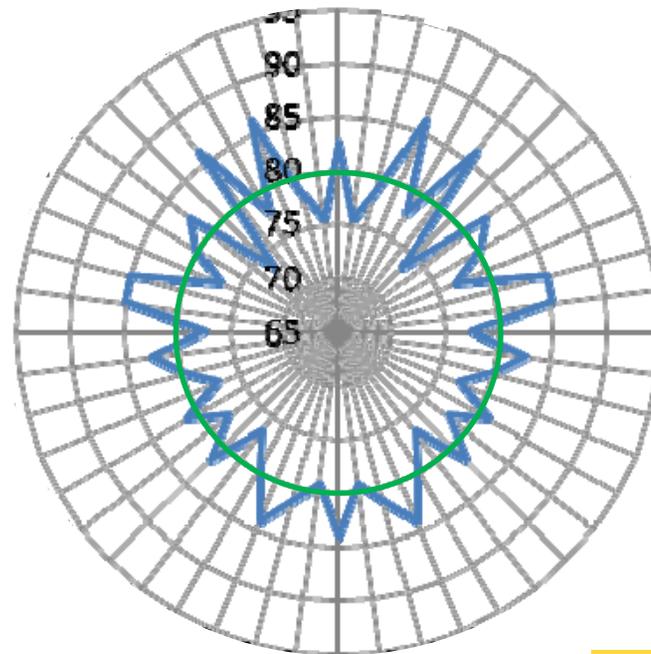
— Omni-noise as measured in the beam
— Historical omni-noise @ 80 dB

T=0.9163 Hours



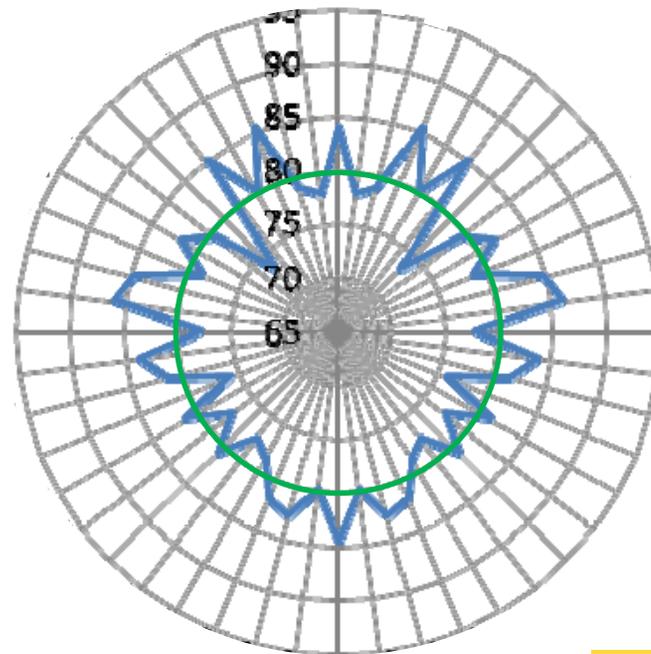
— Omni-noise as measured in the beam
— Historical omni-noise @ 80 dB

T=0.9996 Hours



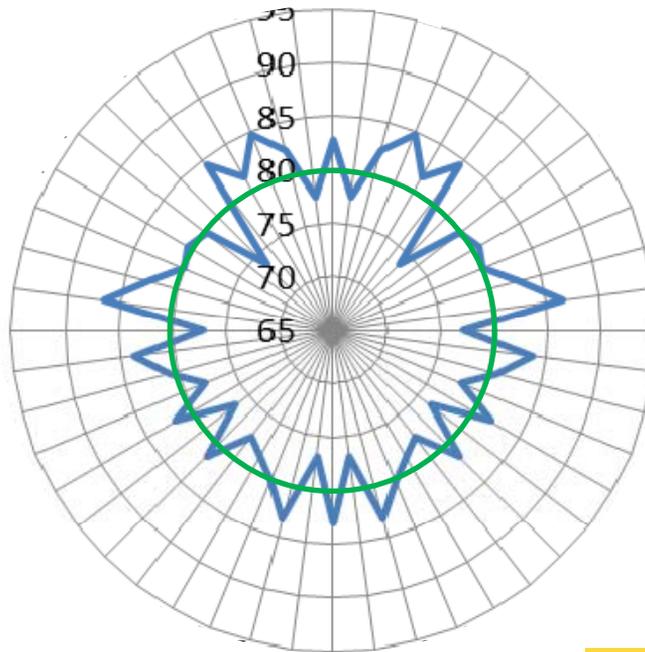
— Omni-noise as measured in the beam
— Historical omni-noise @ 80 dB

T=1.0829 Hours



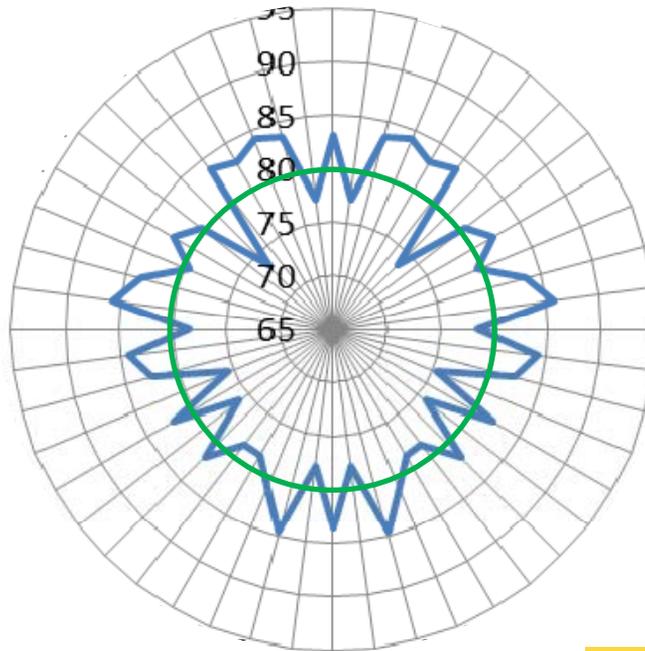
— Omni-noise as measured in the beam
— Historical omni-noise @ 80 dB

T=1.1662 Hours



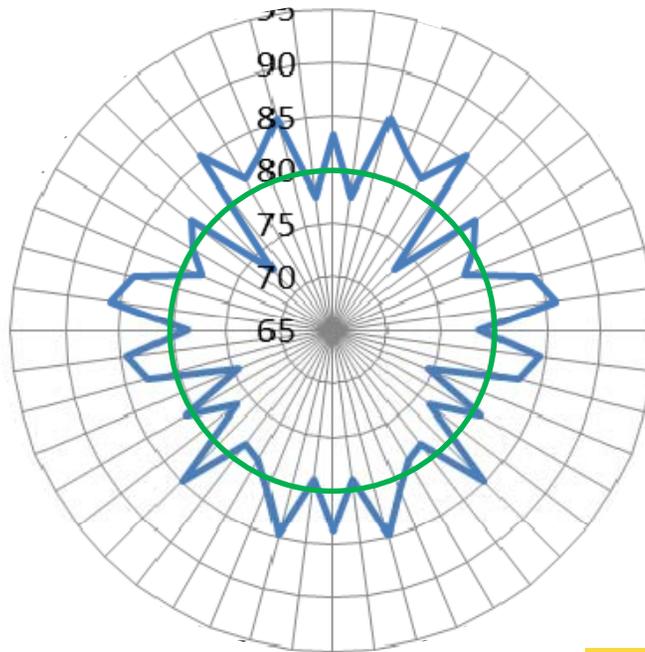
— Omni-noise as measured in the beam
— Historical omni-noise @ 80 dB

T=1.2495 Hours



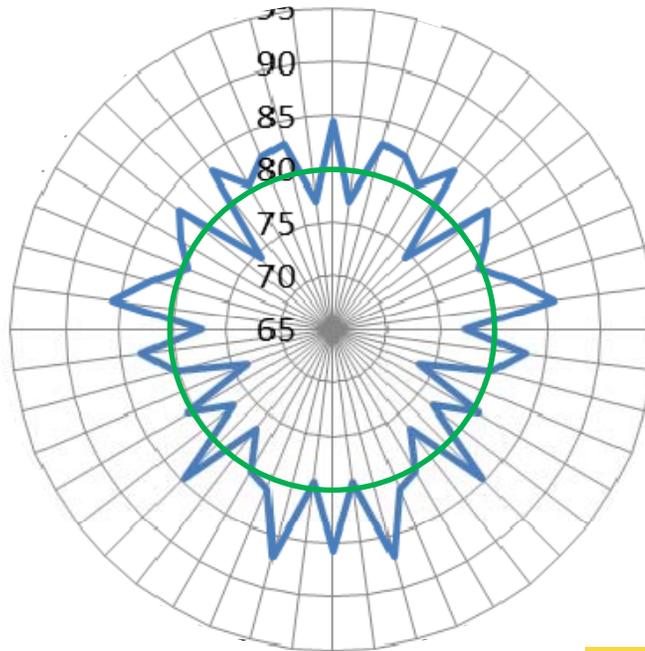
— Omni-noise as measured in the beam
— Historical omni-noise @ 80 dB

T=1.3328 Hours



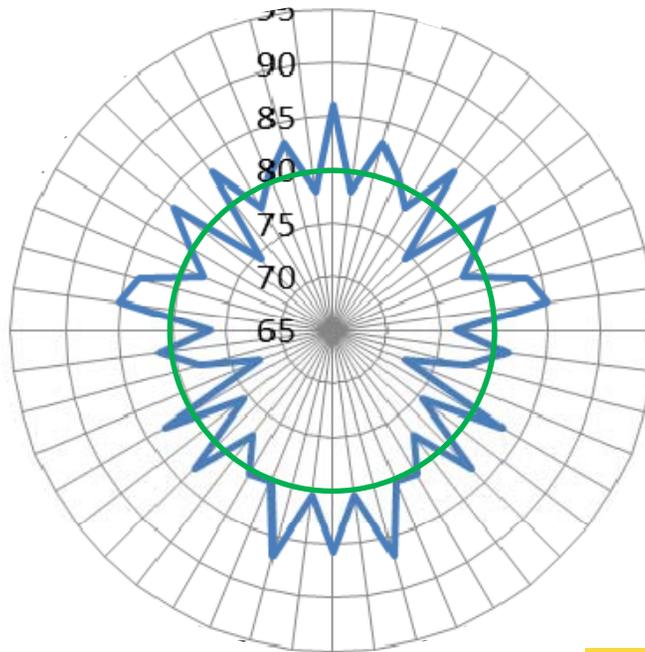
— Omni-noise as measured in the beam
— Historical omni-noise @ 80 dB

T=1.4161 Hours



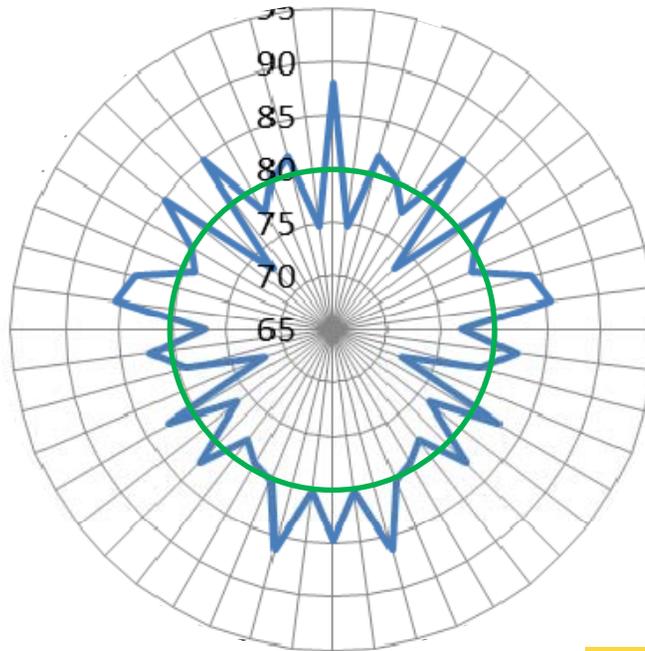
— Omni-noise as measured in the beam
— Historical omni-noise @ 80 dB

T=1.4994 Hours



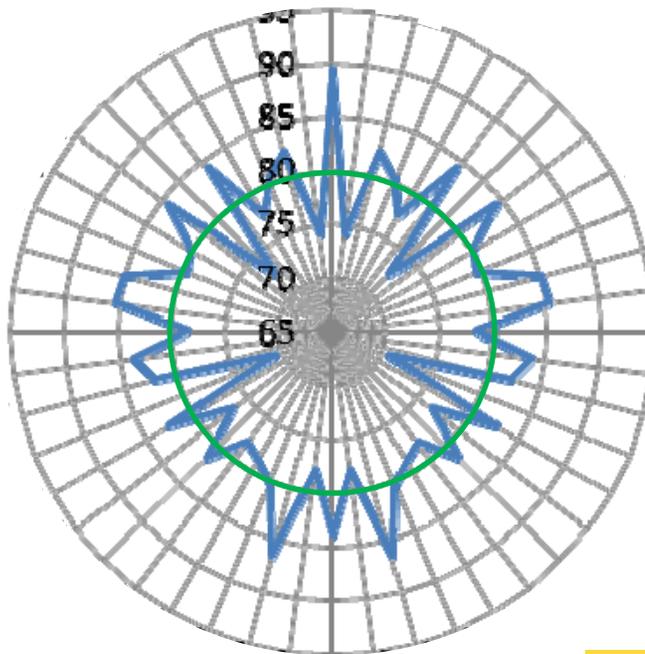
— Omni-noise as measured in the beam
— Historical omni-noise @ 80 dB

T=1.5827 Hours



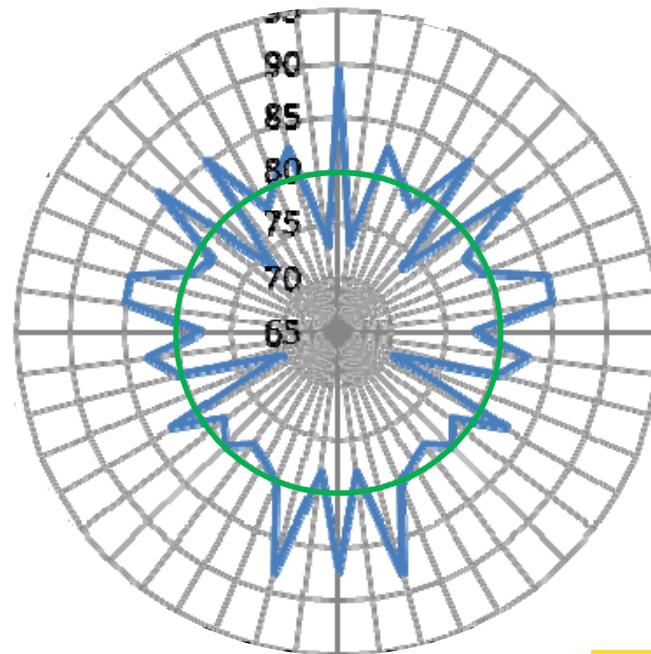
— Omni-noise as measured in the beam
— Historical omni-noise @ 80 dB

T=1.666 Hours



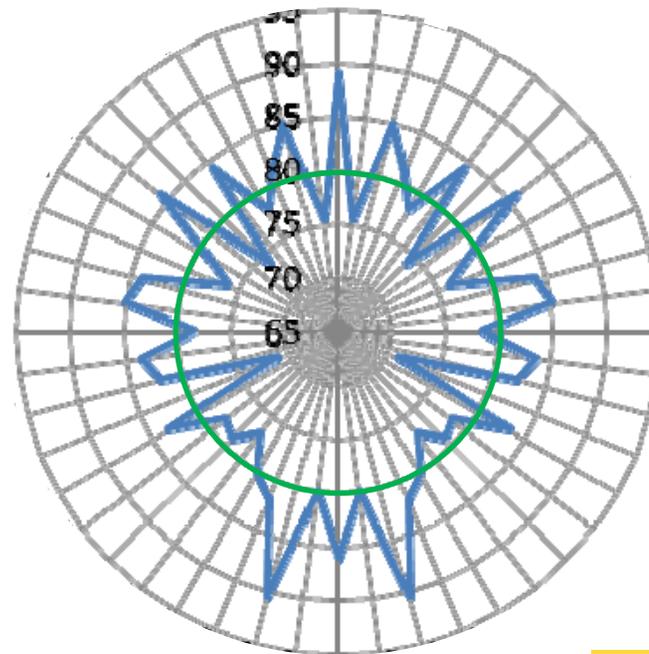
— Omni-noise as measured in the beam
— Historical omni-noise @ 80 dB

T=1.7493 Hours



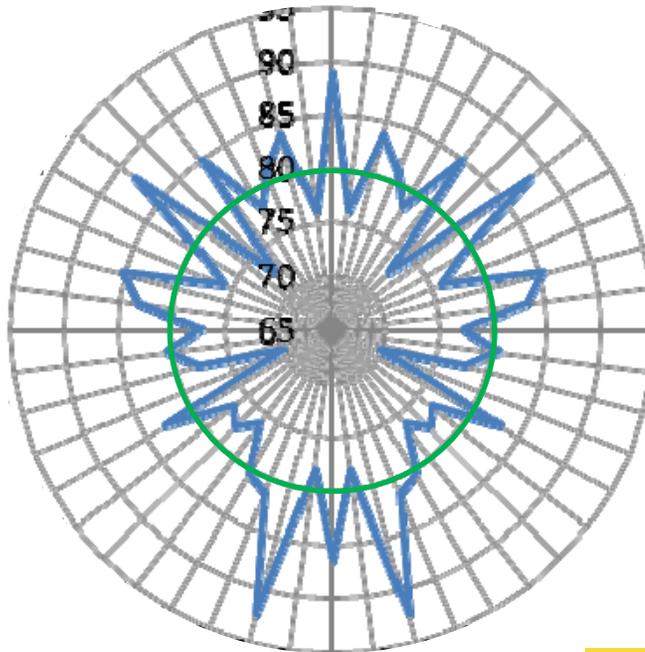
— Omni-noise as measured in the beam
— Historical omni-noise @ 80 dB

T=1.8326 Hours



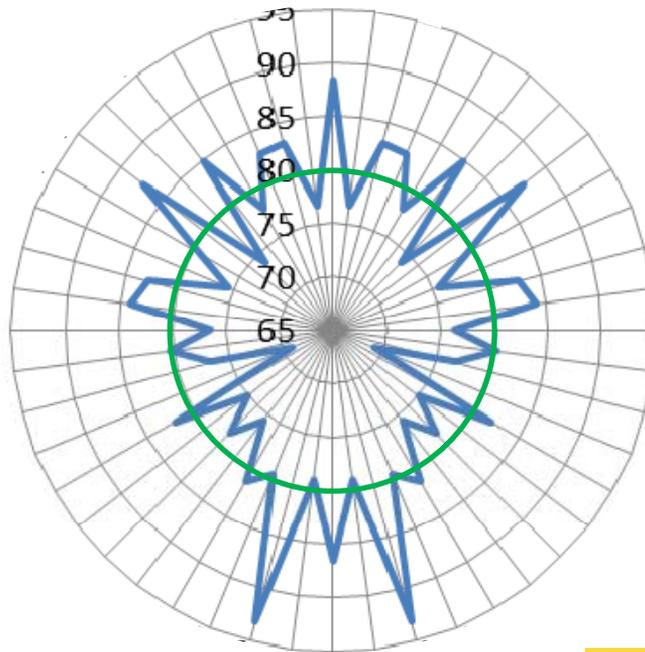
— Omni-noise as measured in the beam
— Historical omni-noise @ 80 dB

T=1.9159 Hours



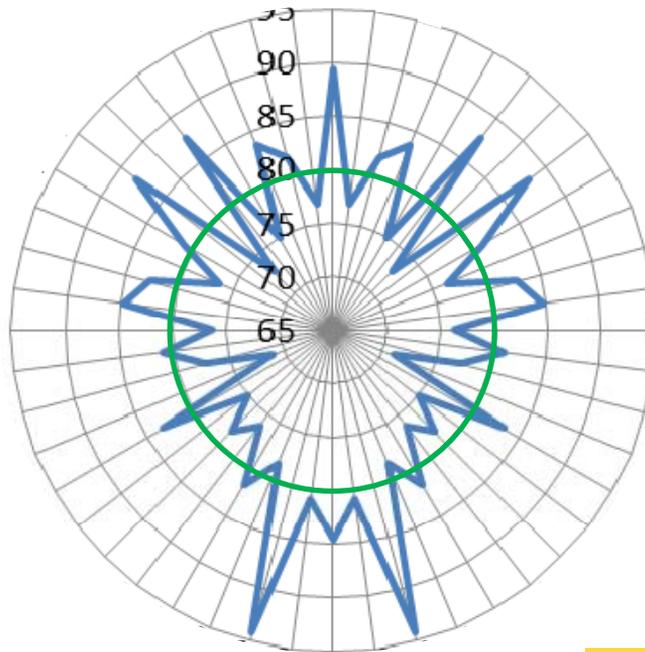
— Omni-noise as measured in the beam
— Historical omni-noise @ 80 dB

T=1.9992 Hours



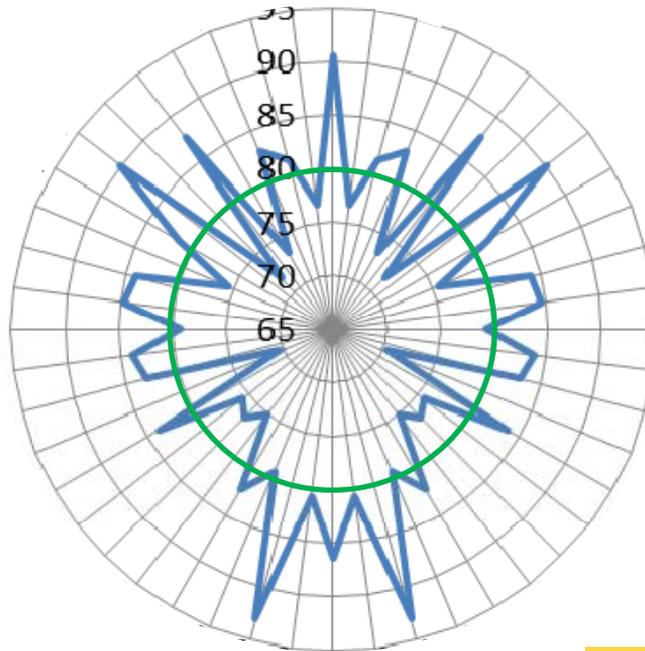
— Omni-noise as measured in the beam
— Historical omni-noise @ 80 dB

T=2.0825 Hours



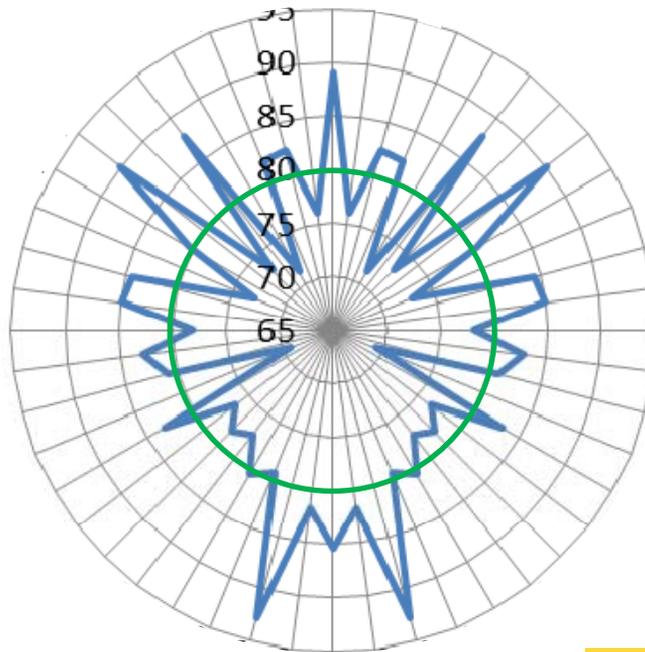
— Omni-noise as measured in the beam
— Historical omni-noise @ 80 dB

T=2.1658 Hours



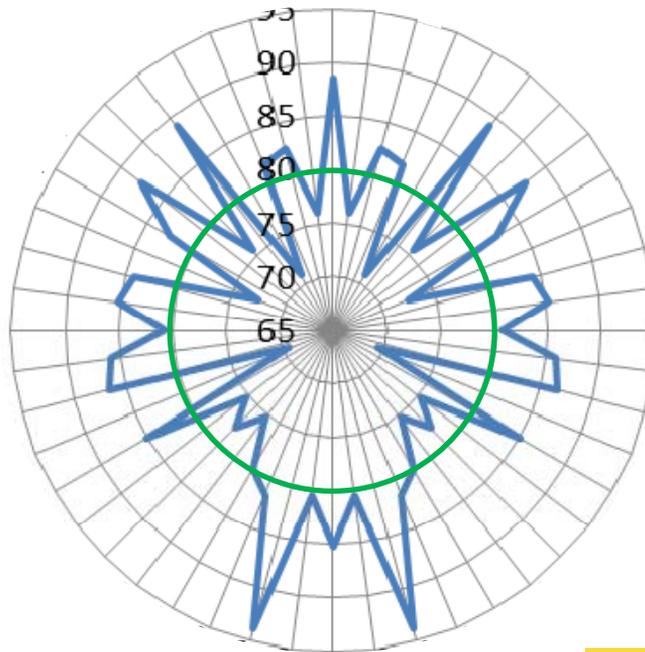
— Omni-noise as measured in the beam
— Historical omni-noise @ 80 dB

T=2.2491 Hours



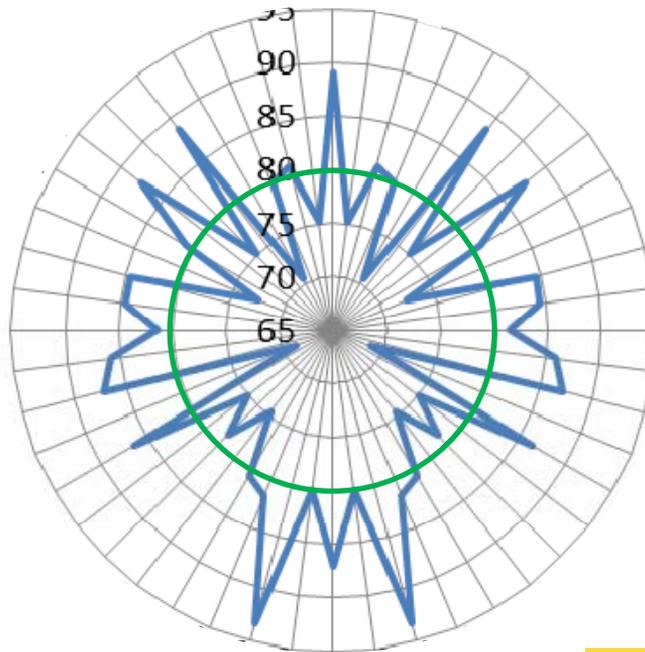
— Omni-noise as measured in the beam
— Historical omni-noise @ 80 dB

T=2.3324 Hours



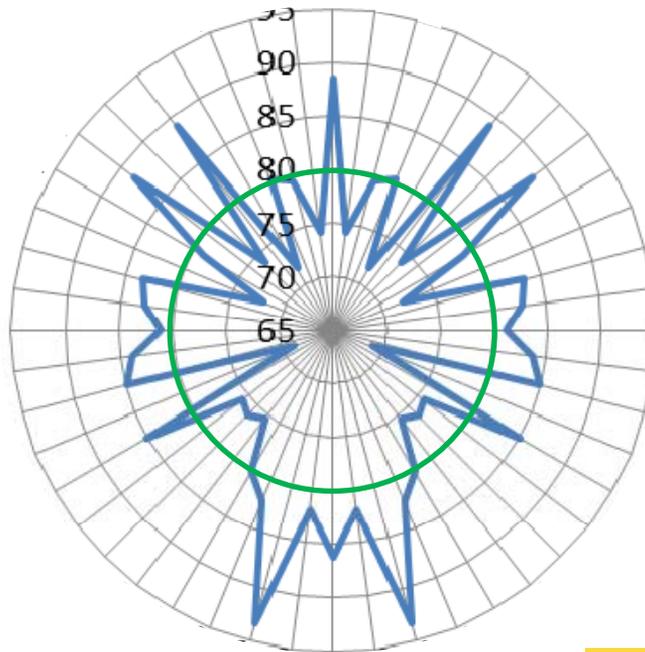
— Omni-noise as measured in the beam
— Historical omni-noise @ 80 dB

T=2.4157 Hours



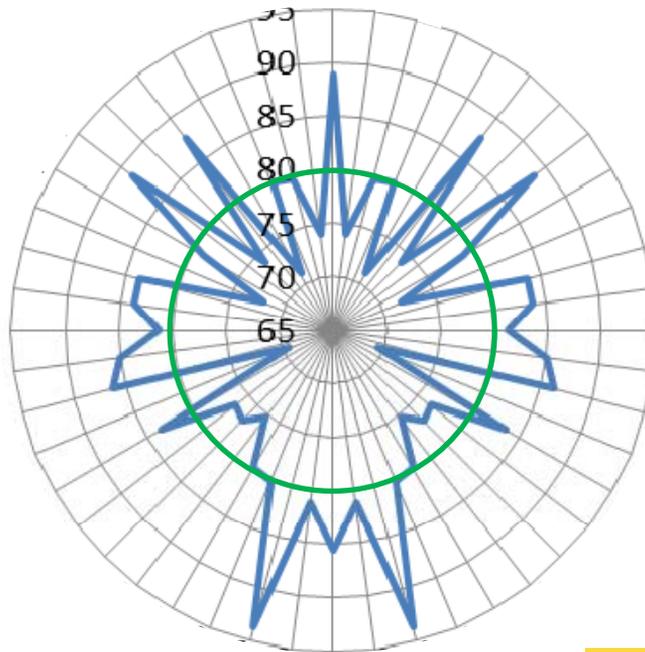
— Omni-noise as measured in the beam
— Historical omni-noise @ 80 dB

T=2.499 Hours



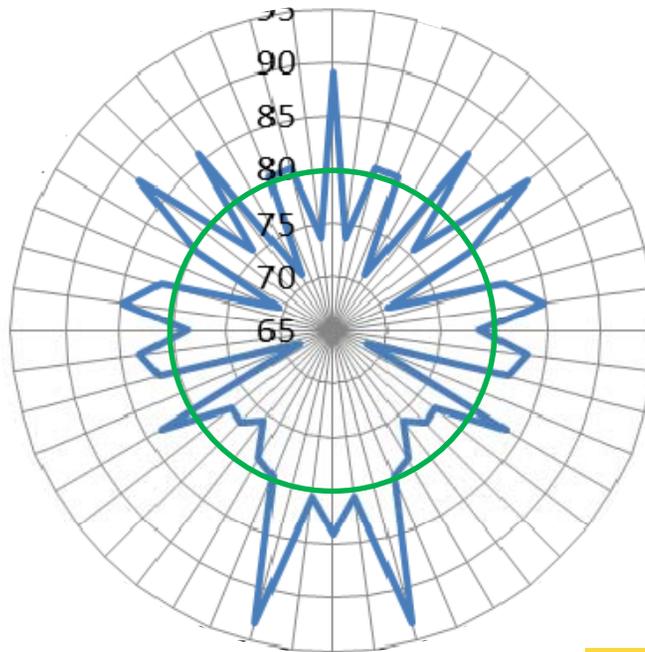
— Omni-noise as measured in the beam
— Historical omni-noise @ 80 dB

T=2.5823 Hours



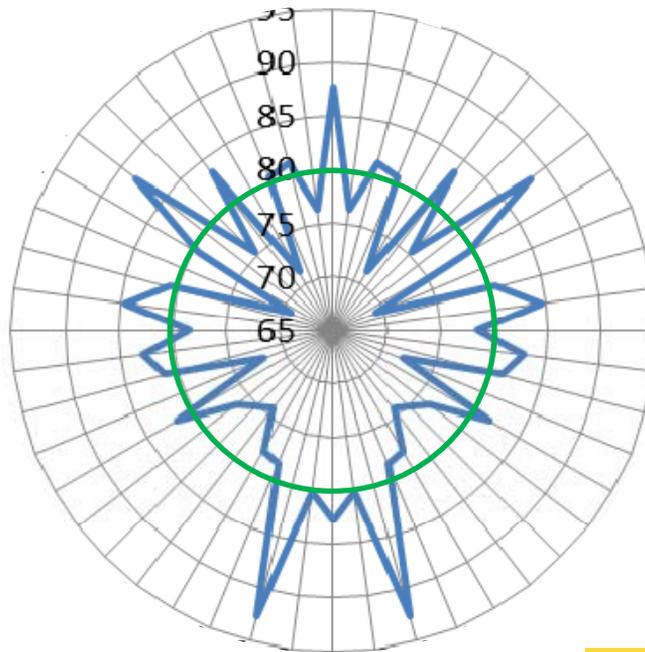
— Omni-noise as measured in the beam
— Historical omni-noise @ 80 dB

T=2.6656 Hours



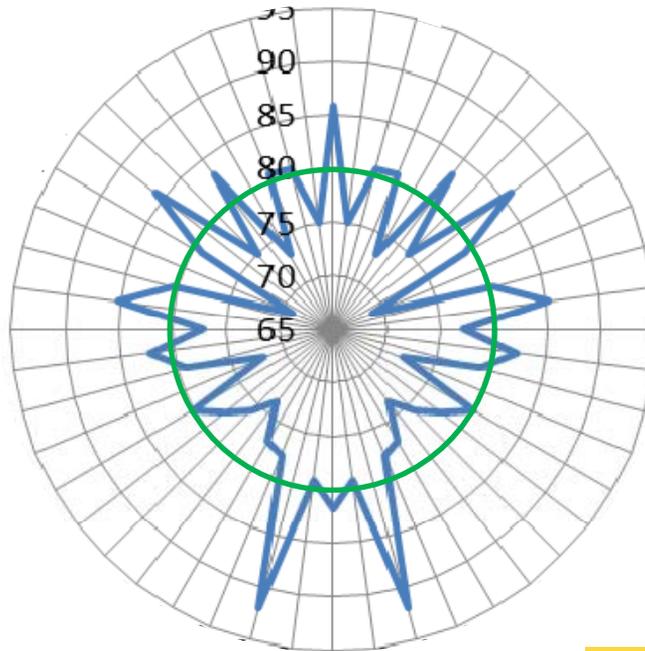
— Omni-noise as measured in the beam
— Historical omni-noise @ 80 dB

T=2.7489 Hours



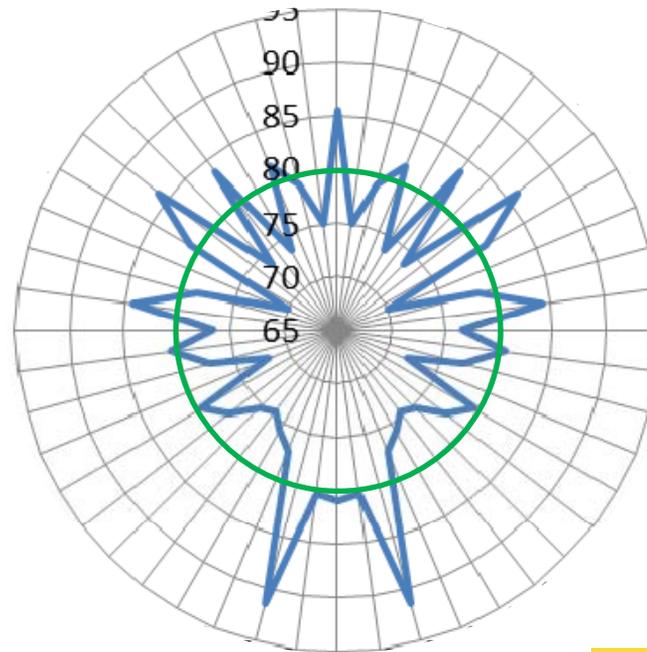
— Omni-noise as measured in the beam
— Historical omni-noise @ 80 dB

T=2.8322 Hours



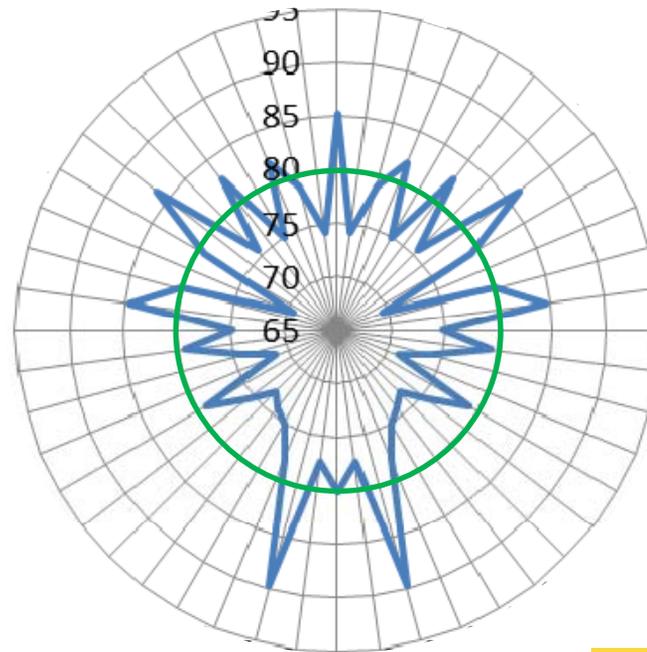
— Omni-noise as measured in the beam
— Historical omni-noise @ 80 dB

T=2.9155 Hours



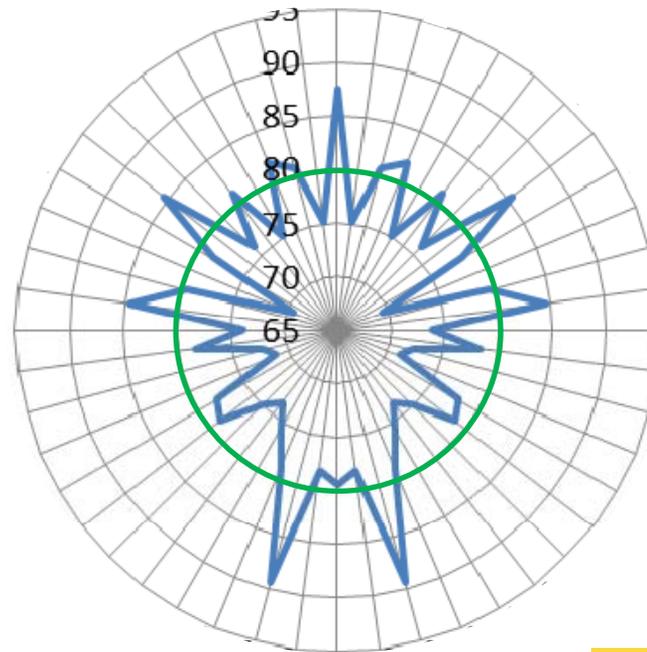
— Omni-noise as measured in the beam
— Historical omni-noise @ 80 dB

T=2.988 Hours



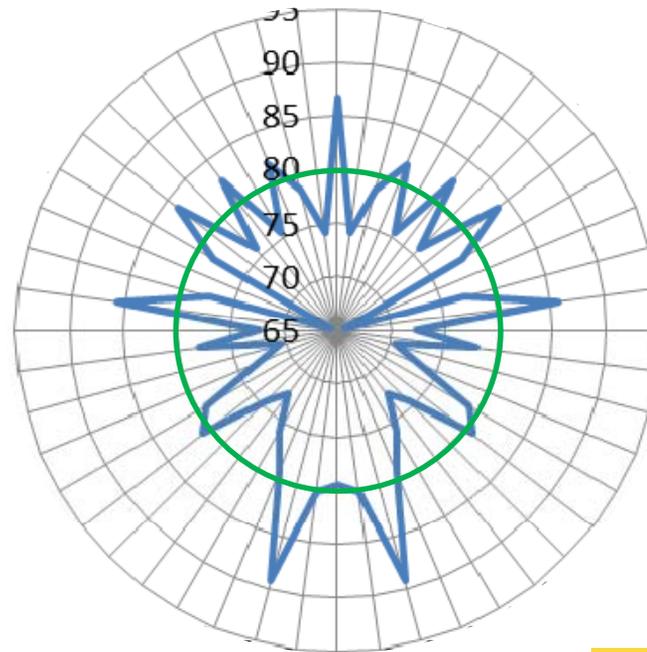
— Omni-noise as measured in the beam
— Historical omni-noise @ 80 dB

T=3.0821 Hours



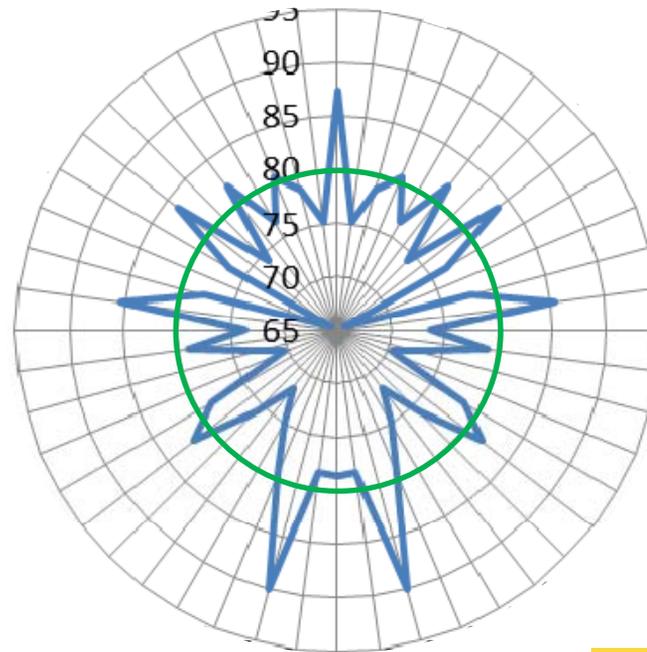
— Omni-noise as measured in the beam
— Historical omni-noise @ 80 dB

T=3.1654 Hours



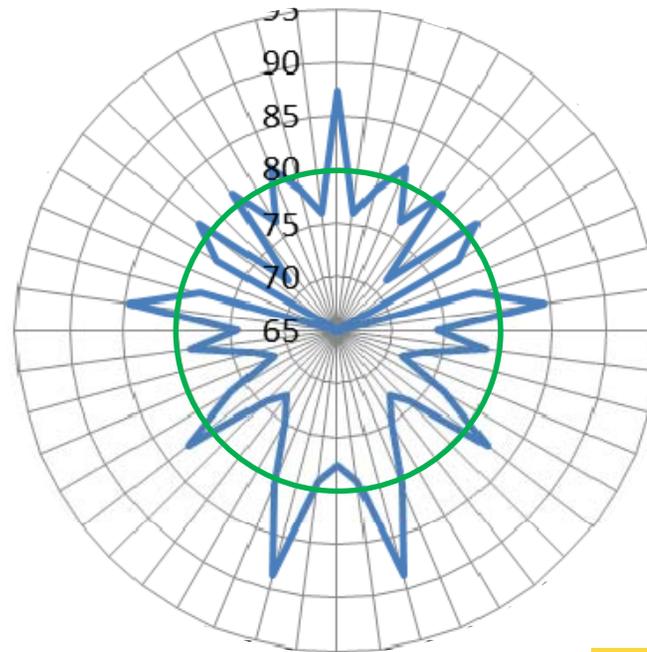
— Omni-noise as measured in the beam
— Historical omni-noise @ 80 dB

T=3.2487 Hours



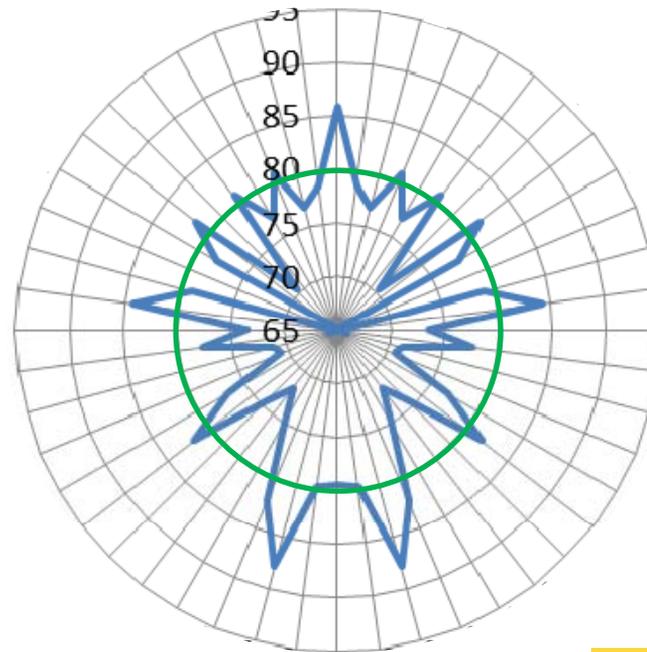
— Omni-noise as measured in the beam
— Historical omni-noise @ 80 dB

T=3.332 Hours



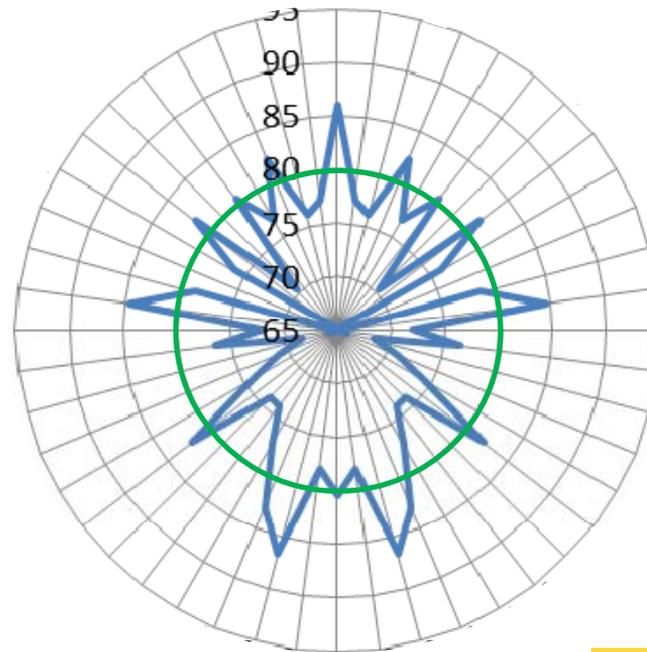
— Omni-noise as measured in the beam
— Historical omni-noise @ 80 dB

T=3.4152 Hours



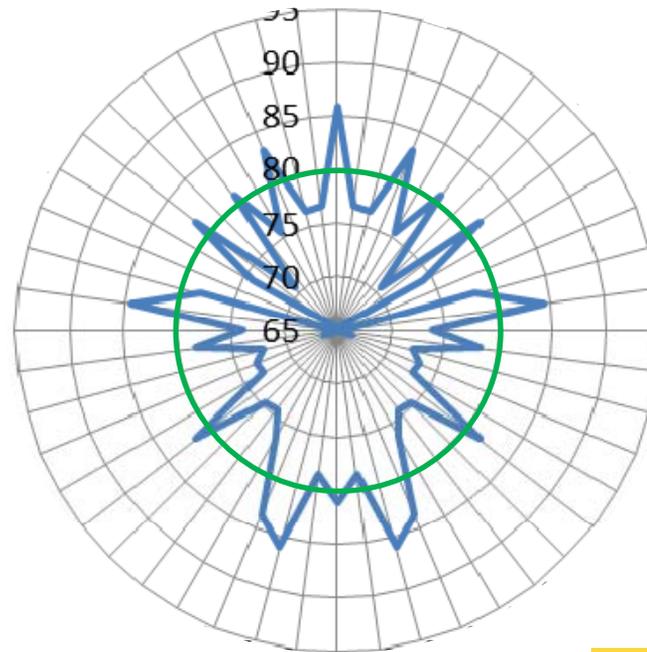
— Omni-noise as measured in the beam
— Historical omni-noise @ 80 dB

T=3.4986 Hours



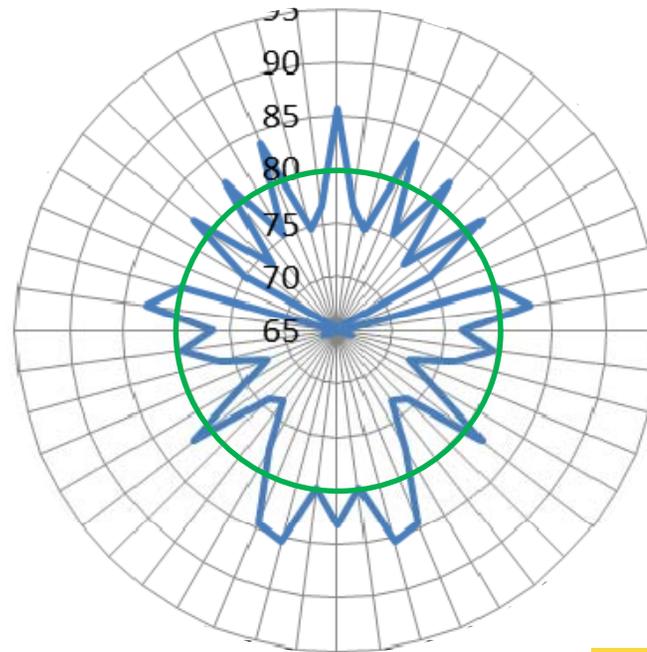
— Omni-noise as measured in the beam
— Historical omni-noise @ 80 dB

T=3.5819 Hours



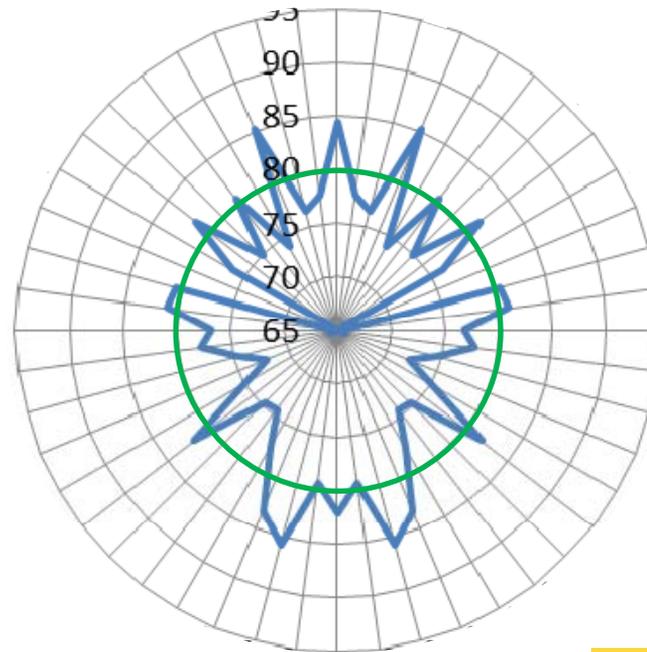
— Omni-noise as measured in the beam
— Historical omni-noise @ 80 dB

T=3.9151 Hours



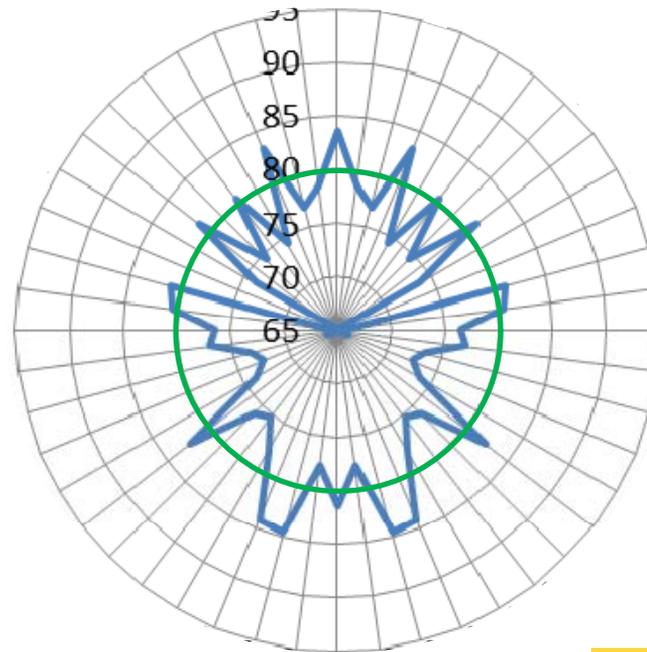
— Omni-noise as measured in the beam
— Historical omni-noise @ 80 dB

T=3.9984 Hours



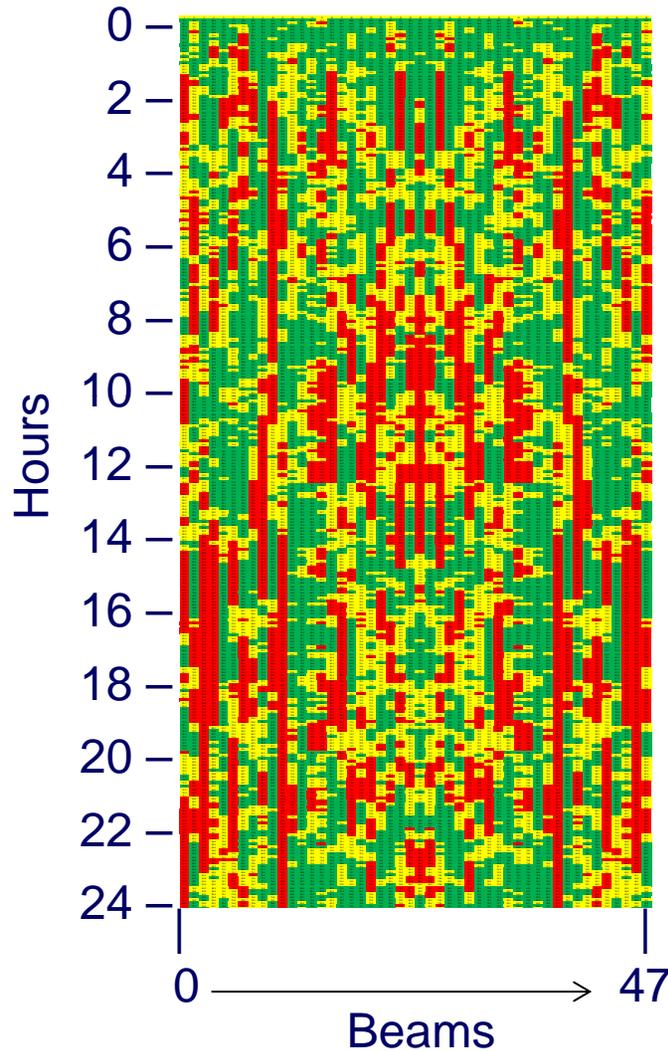
— Omni-noise as measured in the beam
— Historical omni-noise @ 80 dB

T=4.0817 Hours



— Omni-noise as measured in the beam
— Historical omni-noise @ 80 dB

24 Hours of Beam Noise



-  - Ambient Noise within 3 dB of Historical Ave.
-  - Ambient Noise within 6 dB of Historical Ave.
-  - Ambient Noise not within 6 dB of Historical Ave.

Analytic might describe this data as:

- Mean of 84.3 dB
- Gauss-Markov process
 - Time constant of 12 hours
 - Correlated beam-to-beam

The above description is easily shared across low bandwidth networks and can be used to understand statistical performance of the described sensor.

Other **Analytcs** might be applied.

- Alert that ave. ambient noise 4 dB above expected
- Calculate impact on search plan
 - Make recommendations to mitigate
- Identify persistent azimuthal noise field
- ...

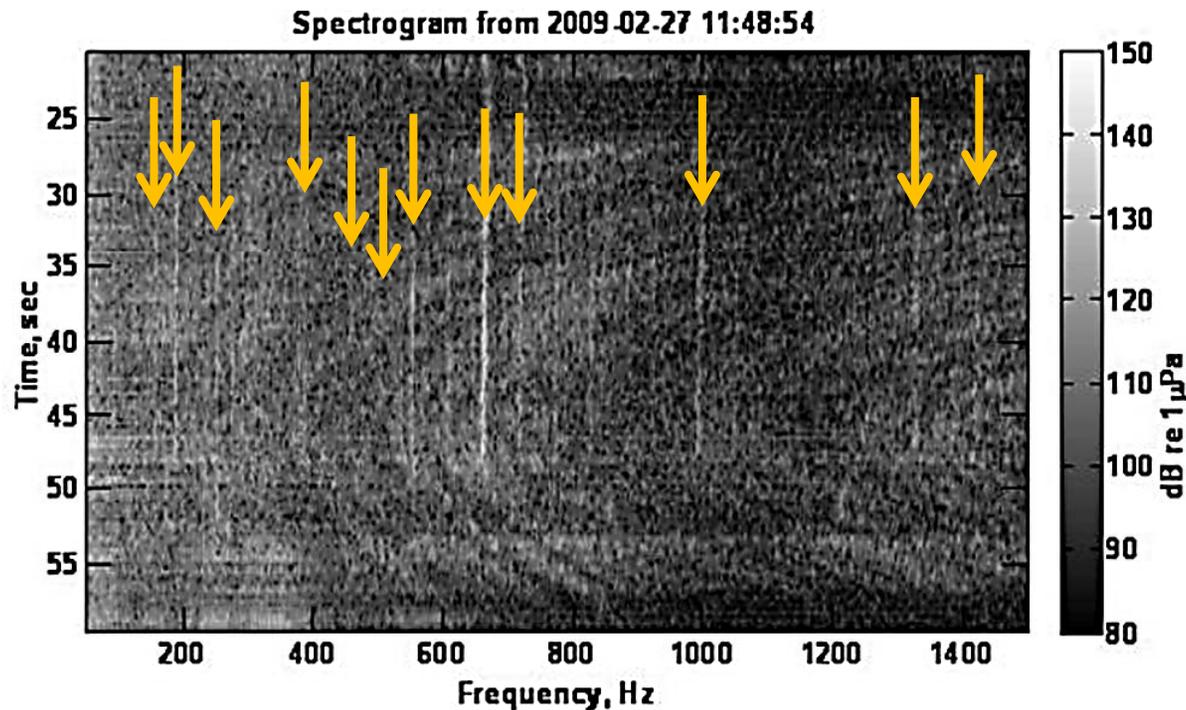
Statistical characterization is invaluable in re-planning and developing Situational Awareness

Intermediate Exemplar of Cloud Analytic in Support of ASW

Acoustic Snippet Aggregation

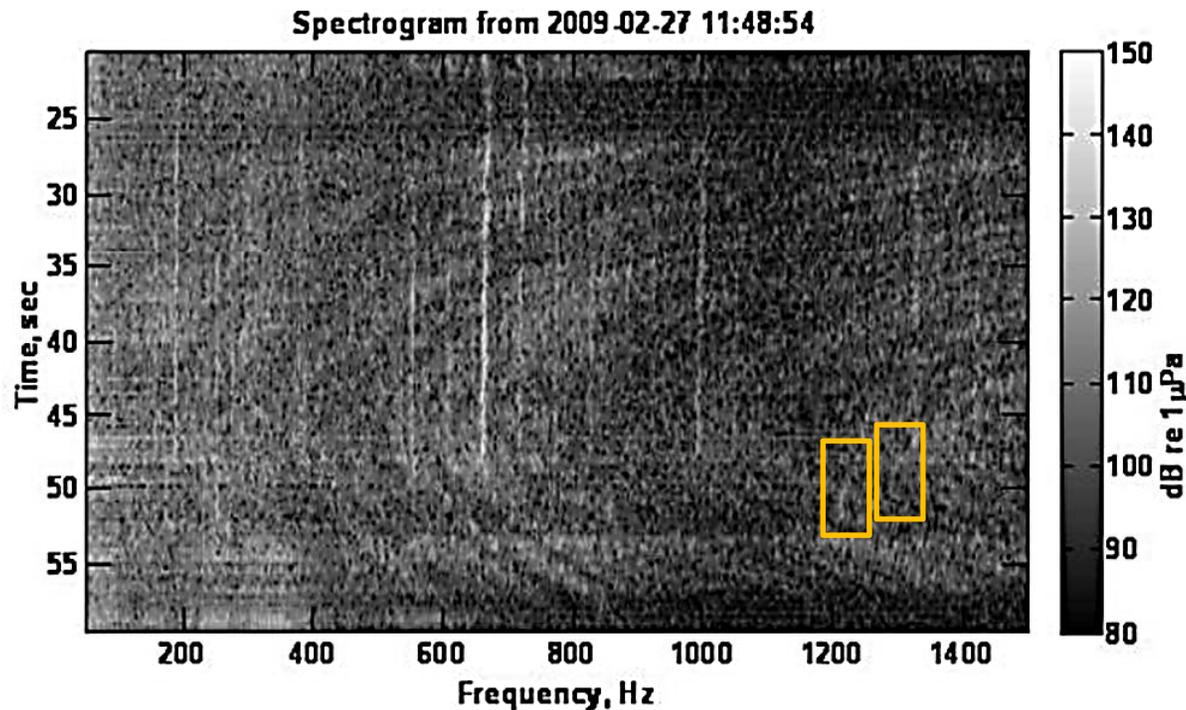
- **Typical framework for identifying contacts of interest and classifying rely on real-time / near real-time activities.**
 - Cueing theory applies and data “customers” are either just served once or not at all.
 - At any one time, the target may not provide sufficient evidence for Blue Force decision-making and action.
- **Through the cloud there is the opportunity to aggregate evidence of the target**
 - Longitudinally with data from the same sensor over time
 - Multiple sensors (including longitudinally) within the same platform
 - Multiple geographically dispersed sensors (including longitudinally)

Exemplar Acoustic Spectrogram



- Spectrogram of a contact
- Many passive narrow band lines are displayed
- Operator classifies target as benign (not a submarine and not a target of interest)

Exemplar Acoustic Spectrogram (Cont.)



- Automated Track Followers had been assigned by sonar system to the boxed signals.
- They were below “threshold” and no alert was generated.
- ATF snippets are recorded in the local cloud.

Candidate Cloud ASW Analytics

1. **Analytic** may be able to generate an alert based on combination of the two snippets if they are related and/or map to the best available ONI data.
2. **Analytic** may be able to combine these snippets with previous instantiations (snippets) recorded from the same or other sensors on that platform.
3. **Analytic** queries other clouds to look for snippets that may be correlated.
 - Acoustic content
 - Satisfies kinematic tests
4. **Local cloud** makes the snippet discoverable to other clouds.

Cloud promotes early detection through system-of-system acoustic data fusion

Reach Exemplar of Cloud Application and Analytics in Support of ASW

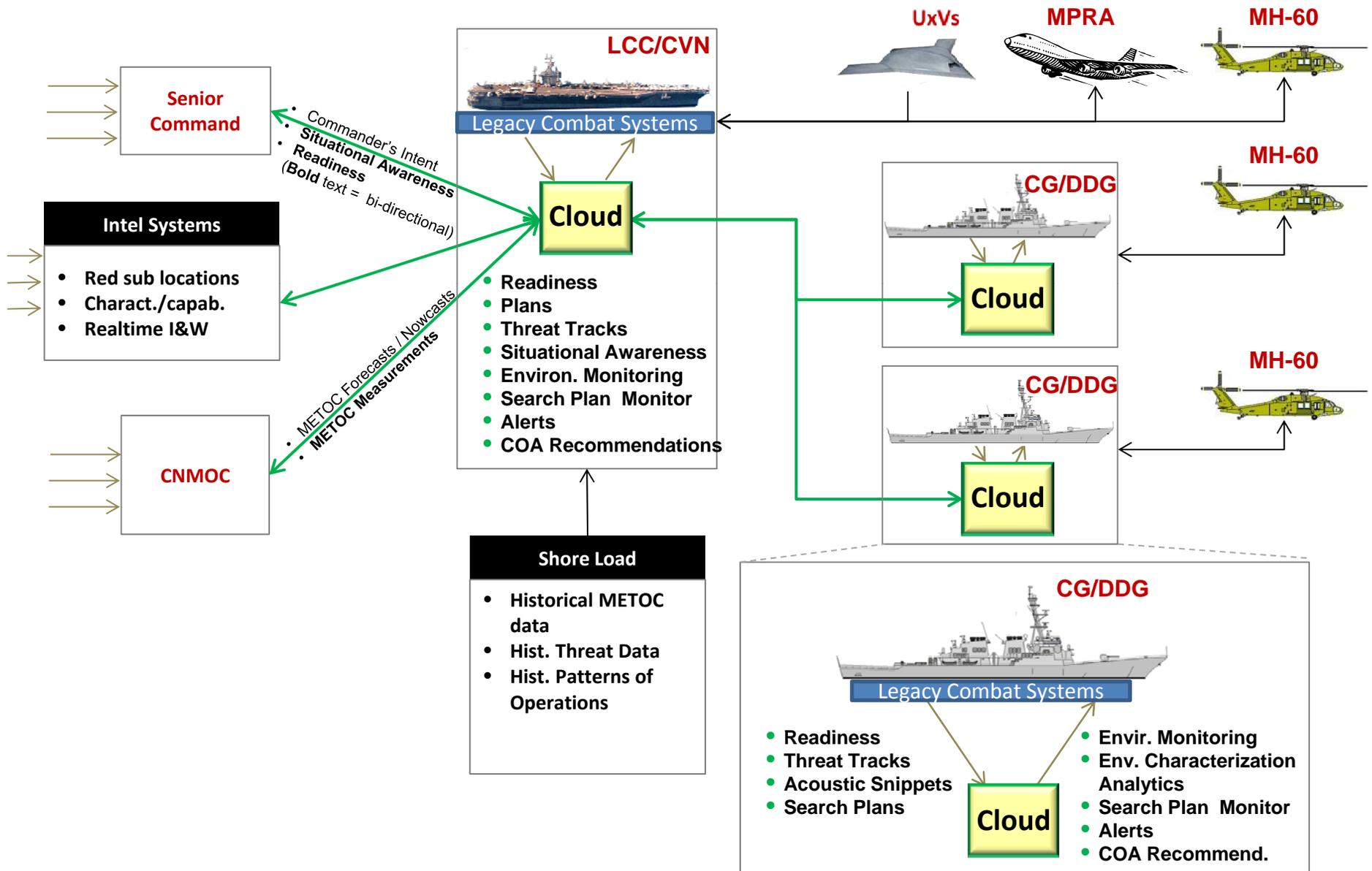
Hypothesis of Opportunity

It is hypothesized that:

- decisions based on better data (and better understood data) will generally promote more effective warfighting decisions.
 - All source data fusion
 - Age and quality of data understood
- analytics that search on meta-data will expose new understanding and promote greater situational awareness.
- that the cloud will make data available for more rapid discovery.
 - Tempo of Blue Force decision-making improved.

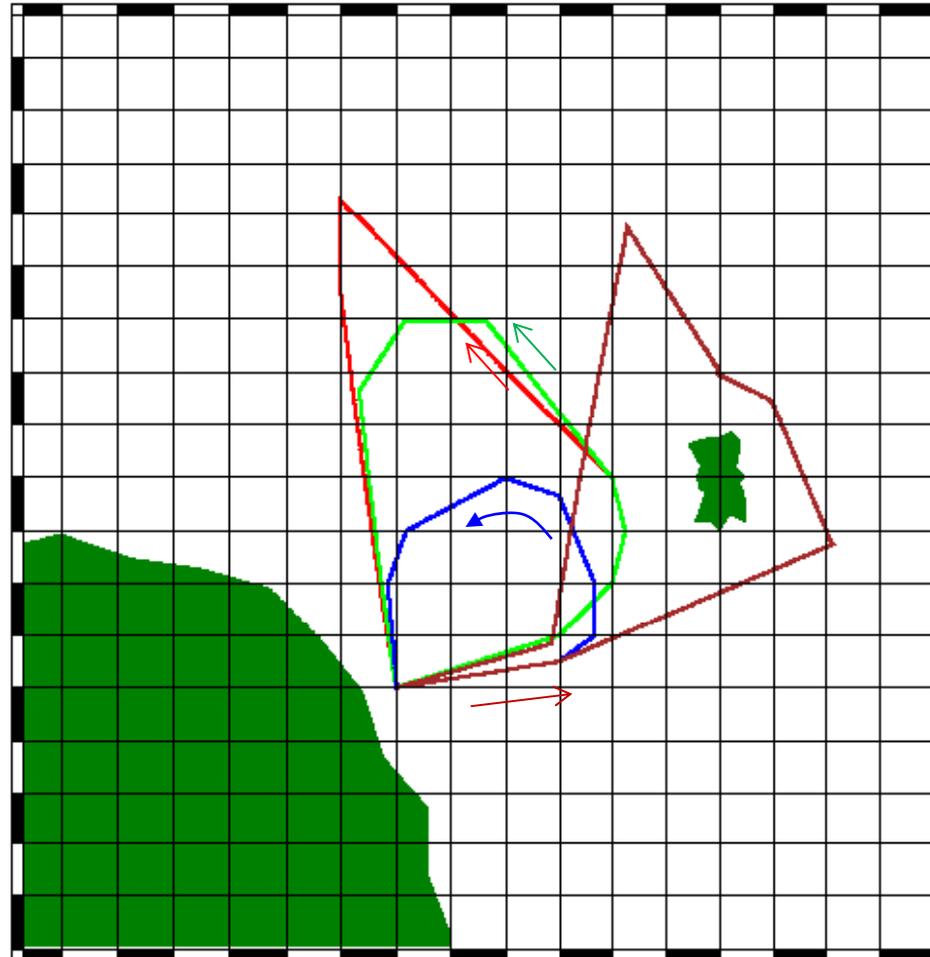
Exploiting the right data at the right place in a timely manner will improve warfighting outcomes

Notional Cloud Opportunity



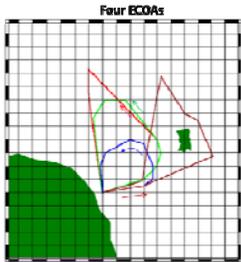
Notional Cloud Opportunity (cont.)

Four ECOAs



Initially, four enemy courses of action are hypothesized for the target of interest.

Notional Cloud Opportunity (cont.)

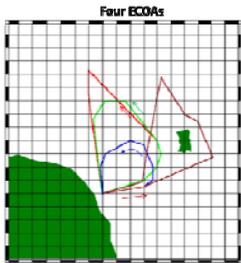


Threat Characterization Data

Best Available Characterization of Threat (by Hull if Available)

Acoustic Data	Signals	Levels	Prob.	Conditions
Weapons Data	Types	#'s	Capab .	TTP
ECOAs	Missions	Operate Profile	TTP	
...				

Notional Cloud Opportunity (cont.)

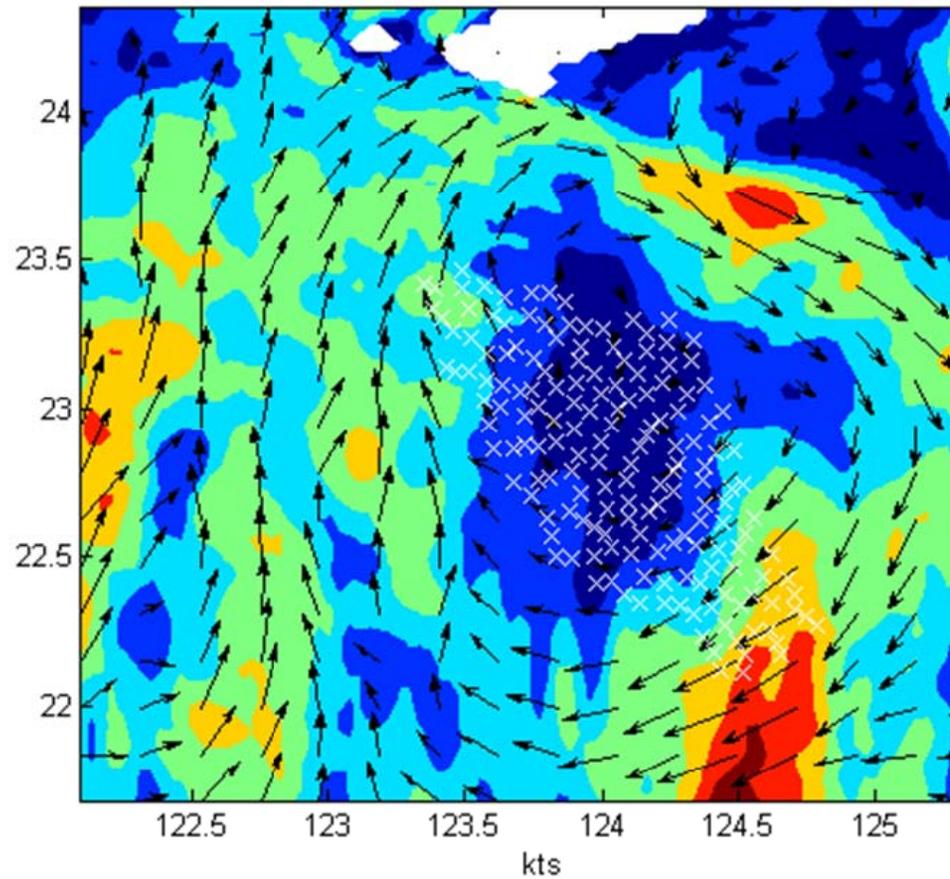


Threat Characterization Data

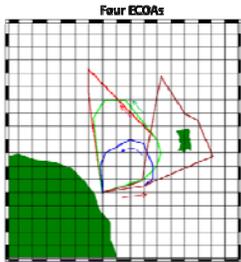
Best Available Characterization of Threat (by Hull if Available)

Acoustic Data	Signals	Levels	Breaks	Conditions
Weapons Data	Type	PI	Capabilities	ETP
ECOAs	Missions	Operational Profile	ETP	

Latest Environmental Data and Projections



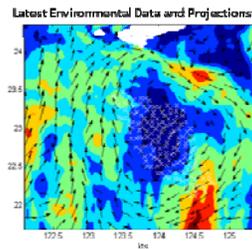
Notional Cloud Opportunity (cont.)



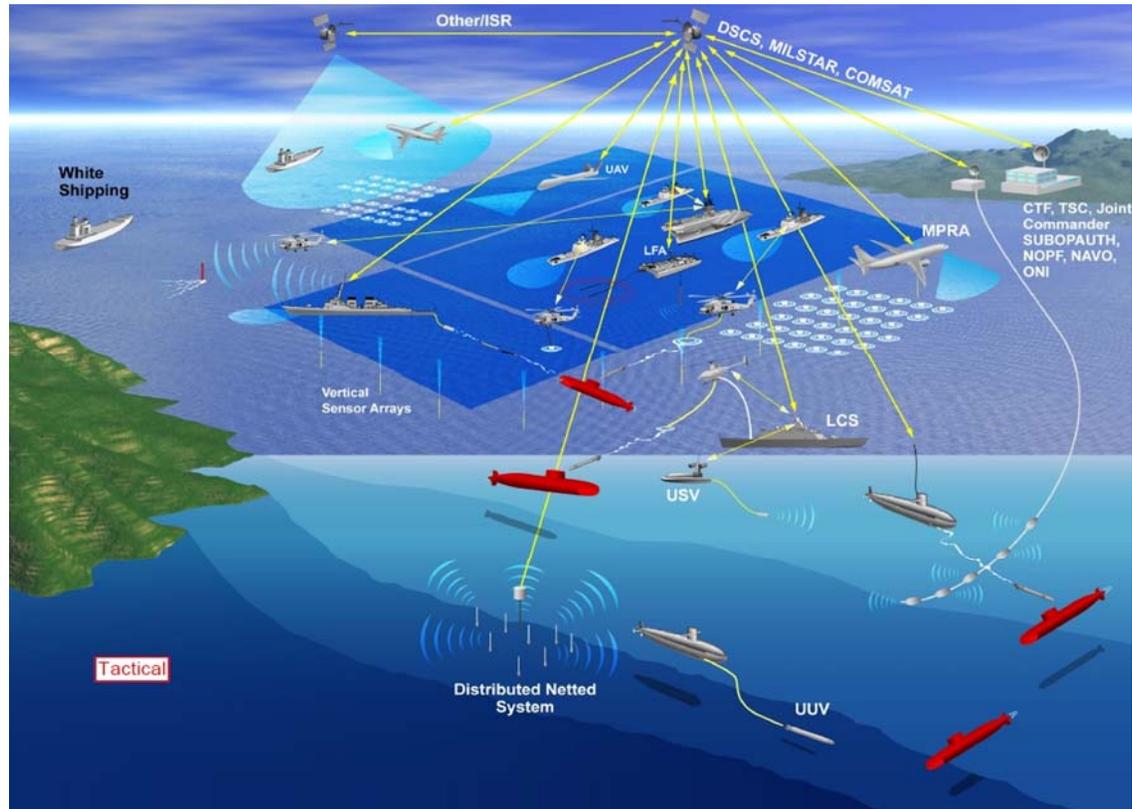
Threat Characterization Data

Best Available Characterization of Threat (by Hull # if Available)

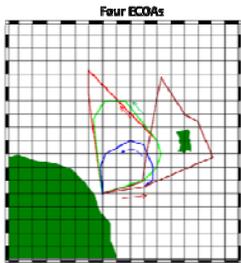
Acoustic Data	Signals	Levels	Brake	Conditions
Weapons Data	Type	#	Capab	TTP
ECOAs	Missions	Operatio Profile	TTP	



Logistics & Readiness Common Operational Picture (COP)



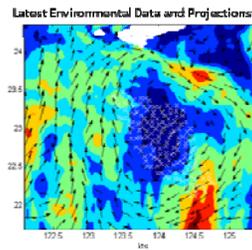
Notional Cloud Opportunity (cont.)



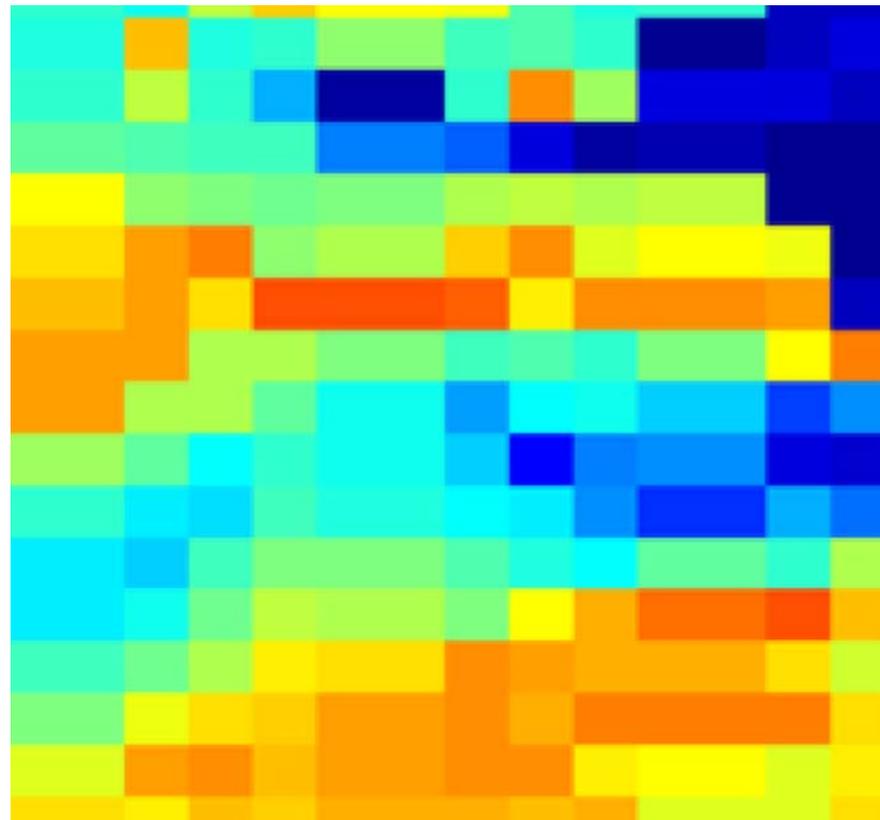
Threat Characterization Data

Best Available Characterization of Threat (by Hull # Available)

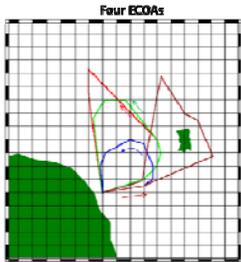
Acoustic Data	Signals	Events	Events	Conditions
Weapons Data	Type	#1	Capabilities	TTP
ECOAs	Missions	Operational Profile	TTP	



Opportunity Plot



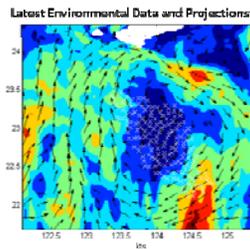
Notional Cloud Opportunity (cont.)



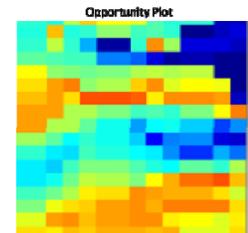
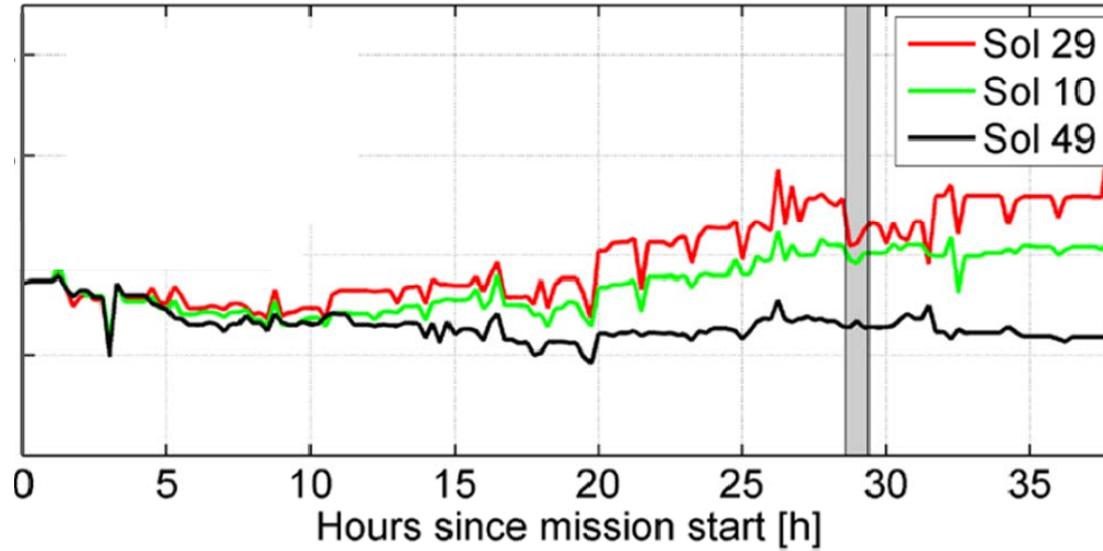
Threat Characterization Data

Best Available Characterization of Threat (by Hull # if Available)

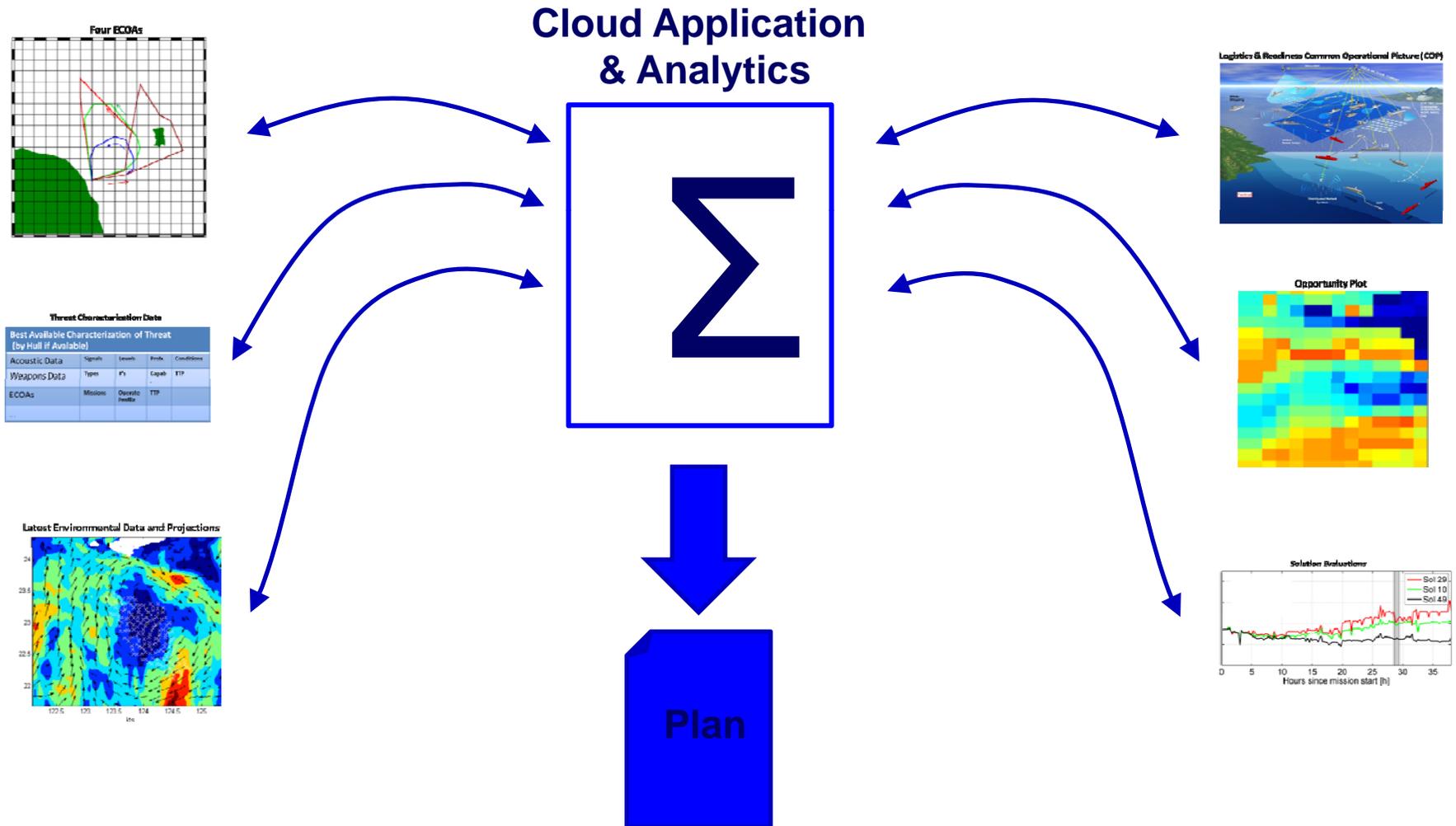
Acoustic Data	Signals	Levels	Brake	Conditions
Weapons Data	Type	#1	Capab	TTP
ECOAs	Missions	Operatio Profile	TTP	



Solution Evaluations



Notional Cloud Opportunity (cont.)



Part #7

Analytic Thrust / IAMD



Key Naval Tactical Cloud Enablers for IAMD

- **Combining traditionally stove-piped information into a single repository**
 - Some data can be used directly
 - New analytics can be developed that work across data sets
- **Ability to store a large volume of information**
 - Saves normally discarded data
 - Long-term pattern extraction
 - Understand state at a given time in the past
- **Ability to efficiently run big data analytics**
 - Previously infeasible questions can now be answered
- **Ability to share information among platforms**
 - Status and readiness information

Example IAMD Analytic Areas

- **Planning**

- Moving assets
- Positioning assets
- Sensor configuration and coverage

- **Situational Awareness**

- Understanding the environment and changes to it
- Examples:
 - Indications and warnings (I&W)
 - Alerts
 - Cueing

- **Identification and Classification**

- Enriched set of attributes from nontraditional data sources
- Example:
 - Recommending ID for an unknown combat system track based on data associated from Command and Control System and/or national technical means



Example IAMD Analytic Areas (cont'd)

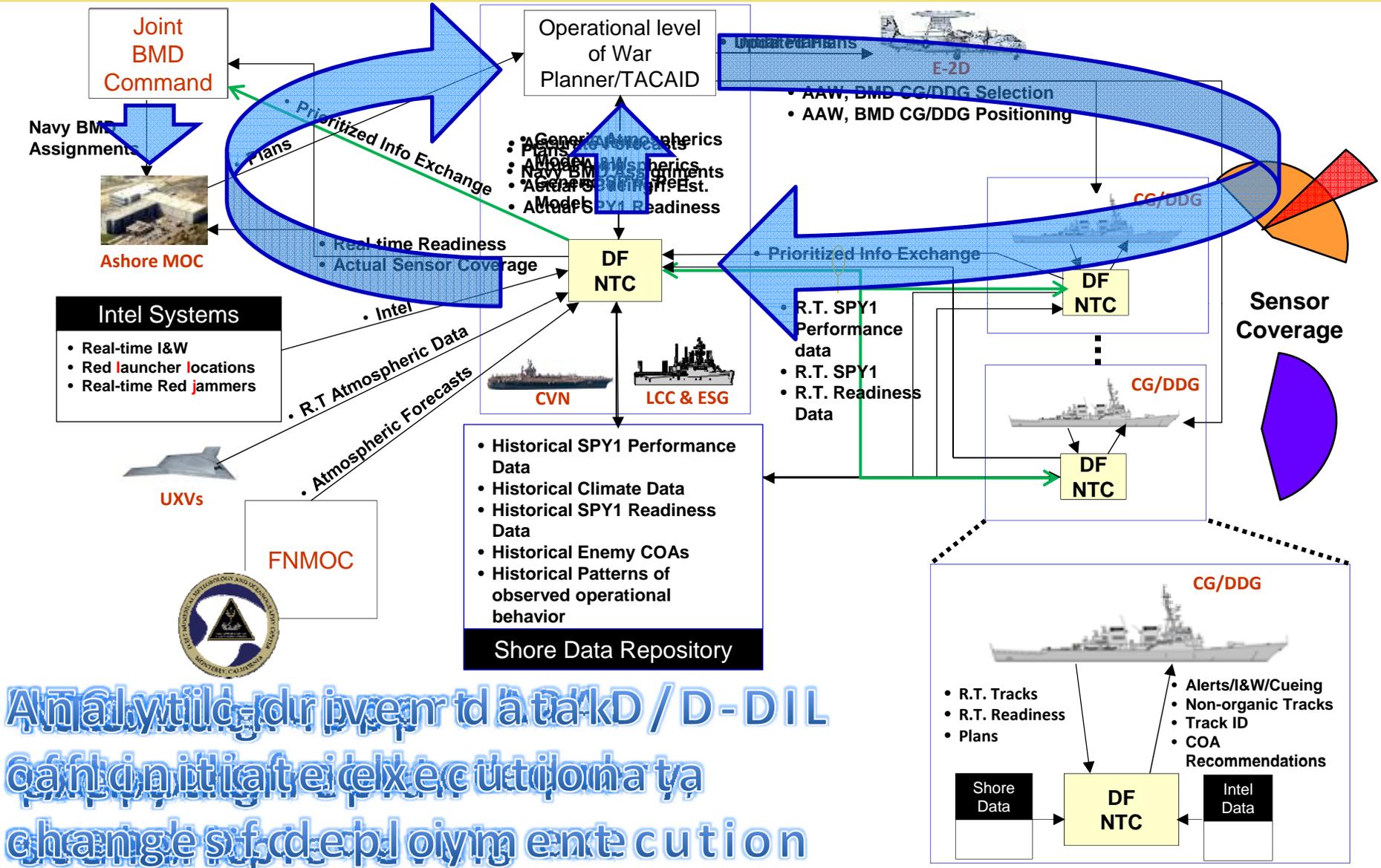
- **Resource Allocation**
 - Spectrum allocation
 - Weapon usage optimization
- **Course of Action (COA) Recommendation**
 - Recommend COA based on observed behavior and rich set of historical behavior
- **Anomaly Detection**
 - Intent and future movement prediction
 - Indications of malicious cyber activity
 - Detection of enemy war reserve capabilities



Example IAMD Use Cases from BAA

- Improved identity classification, intent and future movement prediction, and track association
- Optimizing sensor configuration
- Identifying unexpected Red air and missile capabilities, behaviors, and operational patterns
- Improved planning of asset movement and tactical utilization
- Weapon usage optimization
- Improved spectrum operations
- Improved situational awareness
- Cyber awareness

IAMD Scenario Use Case Examples



Analytics driven to a T&D / D-DIL
 can initiate execution
 change of deployment execution

IAMD Scenario Use Case Examples

Joint
BMD
Command



Ashore MOC

Operational level
of War
Planner/TACAID



CVN

LCC & ESG



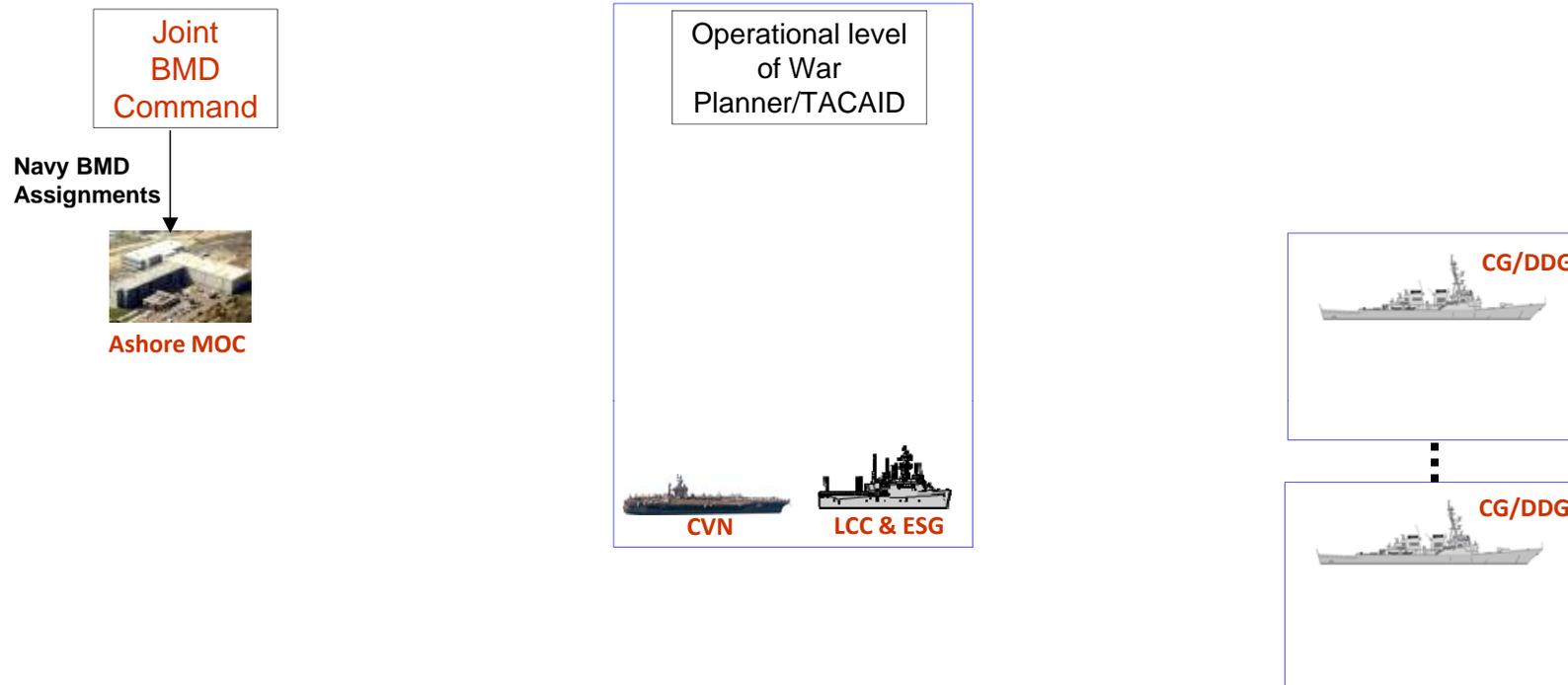
CG/DDG



CG/DDG

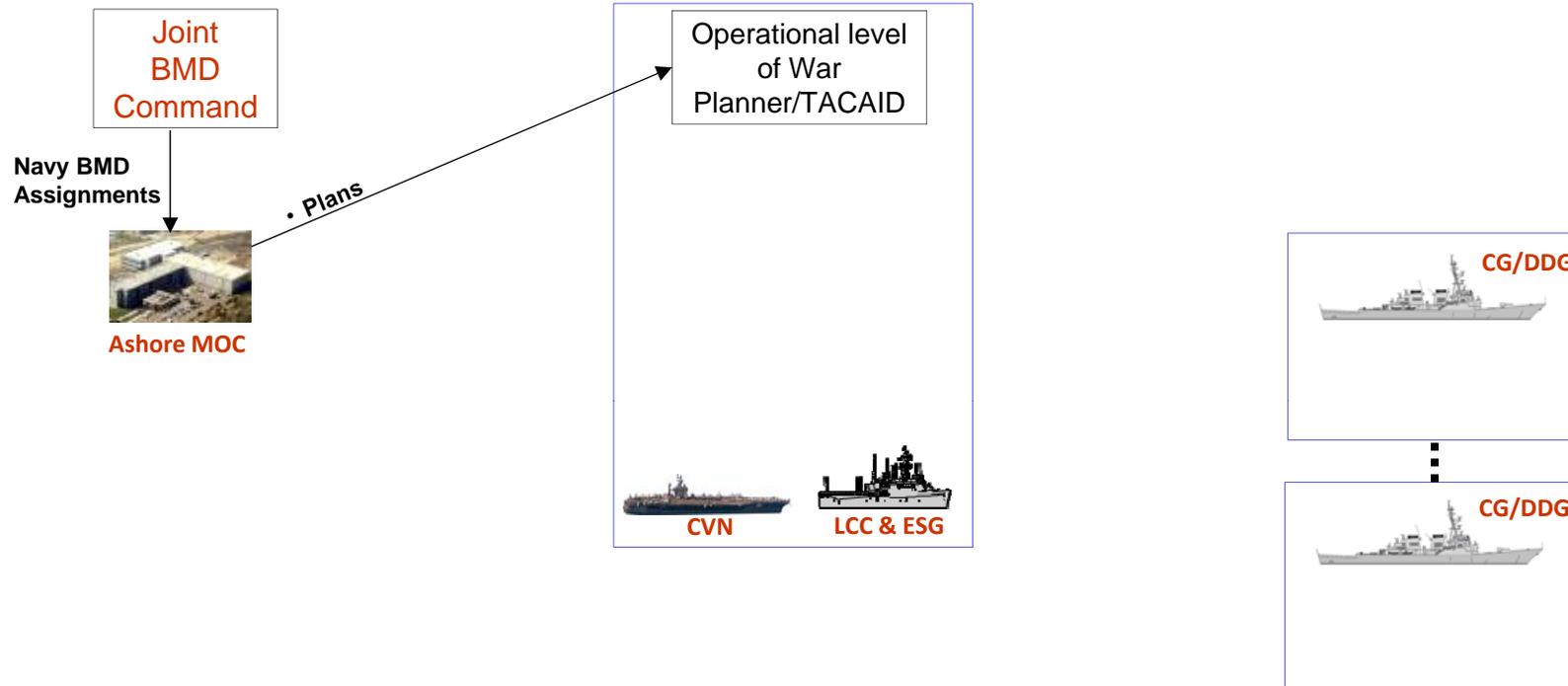
Planning
today

IAMD Scenario Use Case Examples



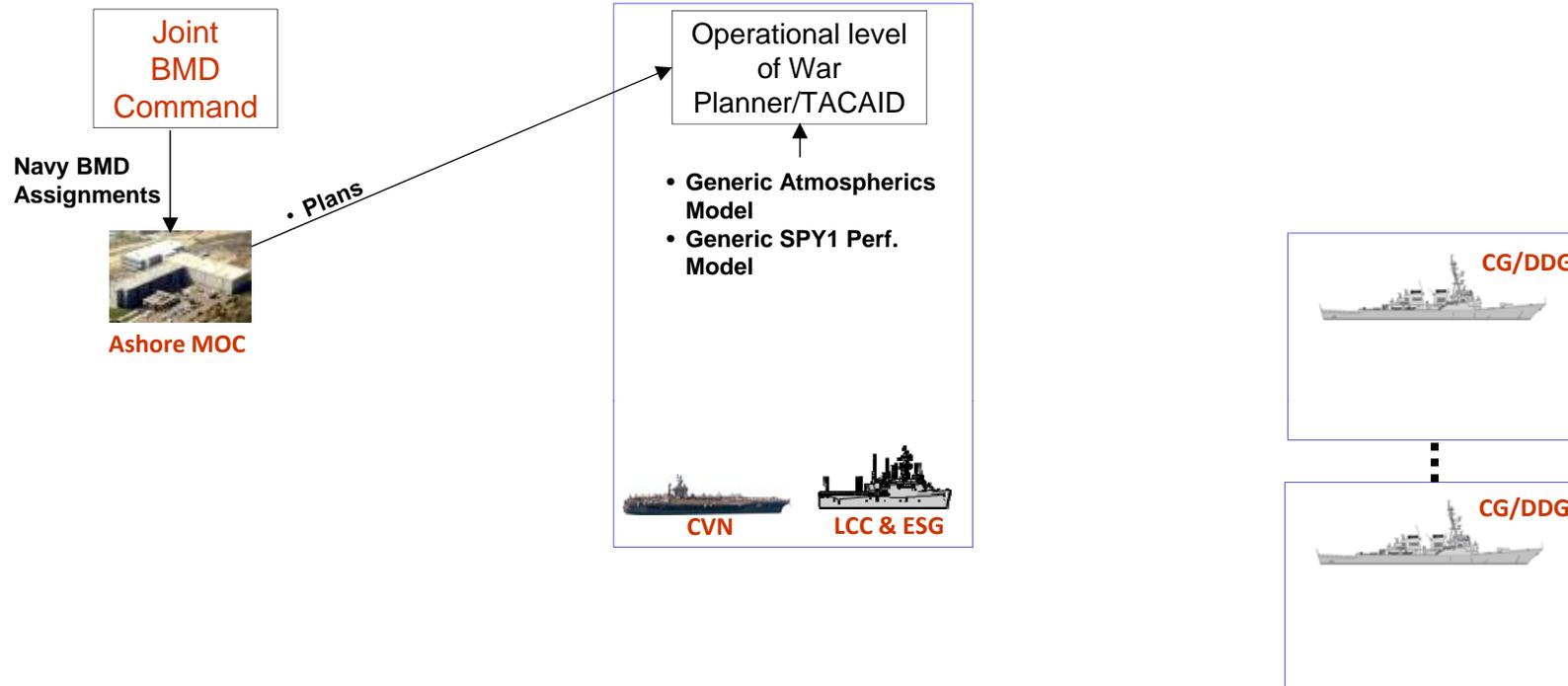
Planning
today

IAMD Scenario Use Case Examples



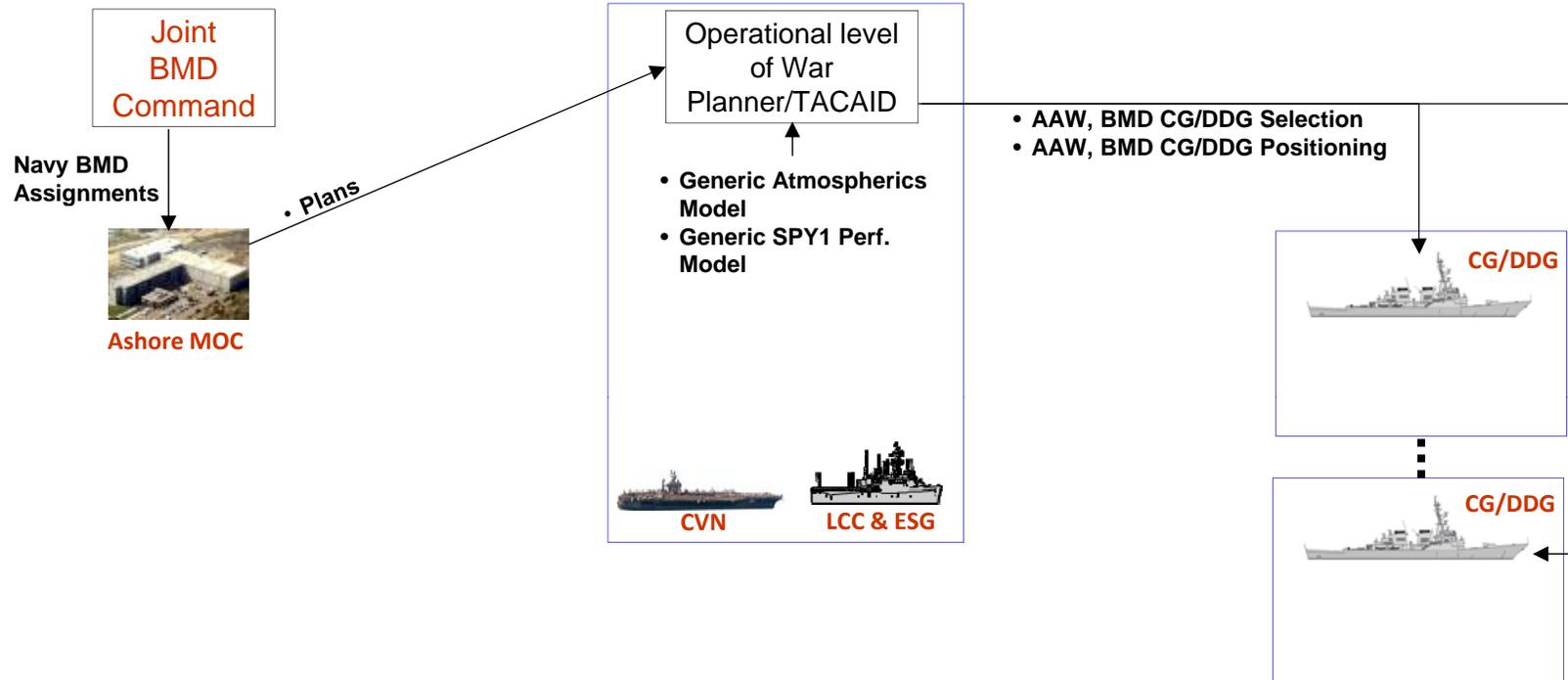
Planning
today

IAMD Scenario Use Case Examples



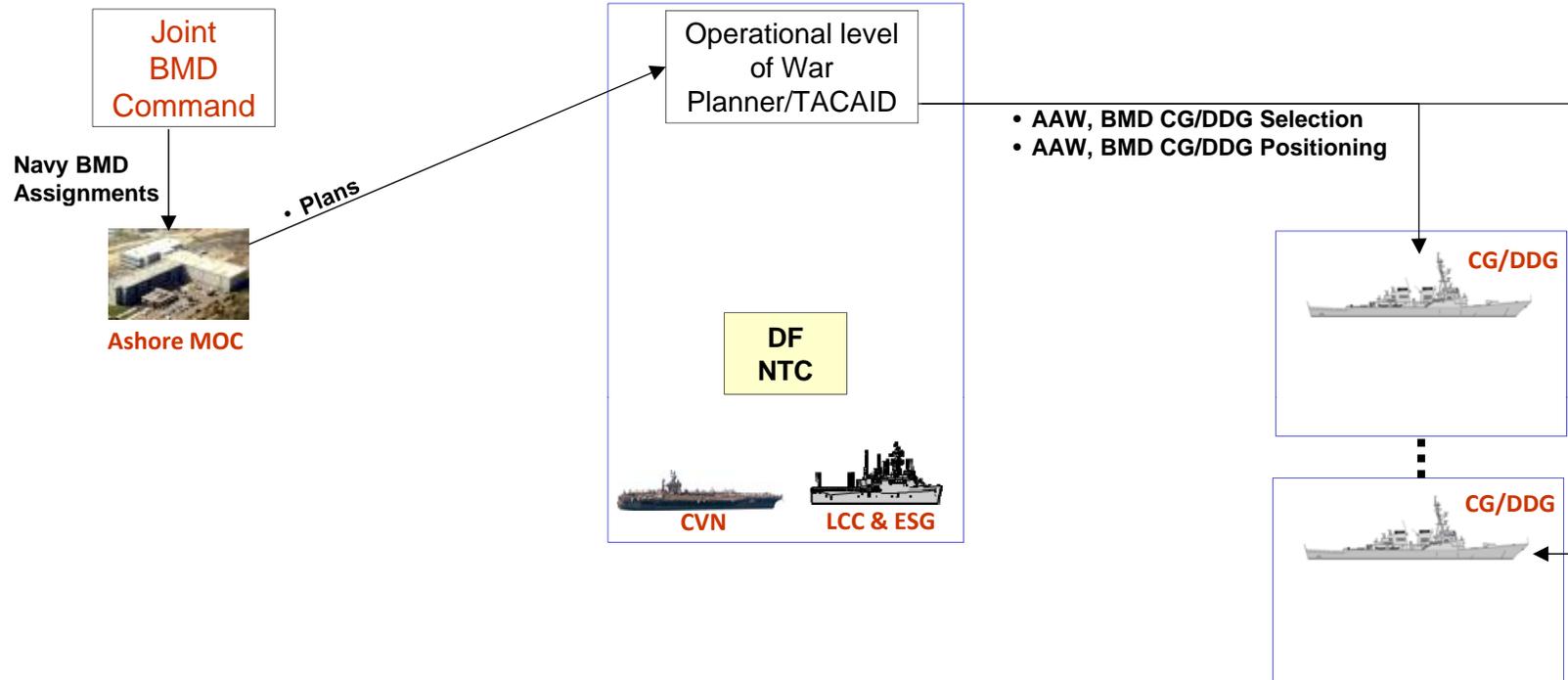
Planning
today

IAMD Scenario Use Case Examples



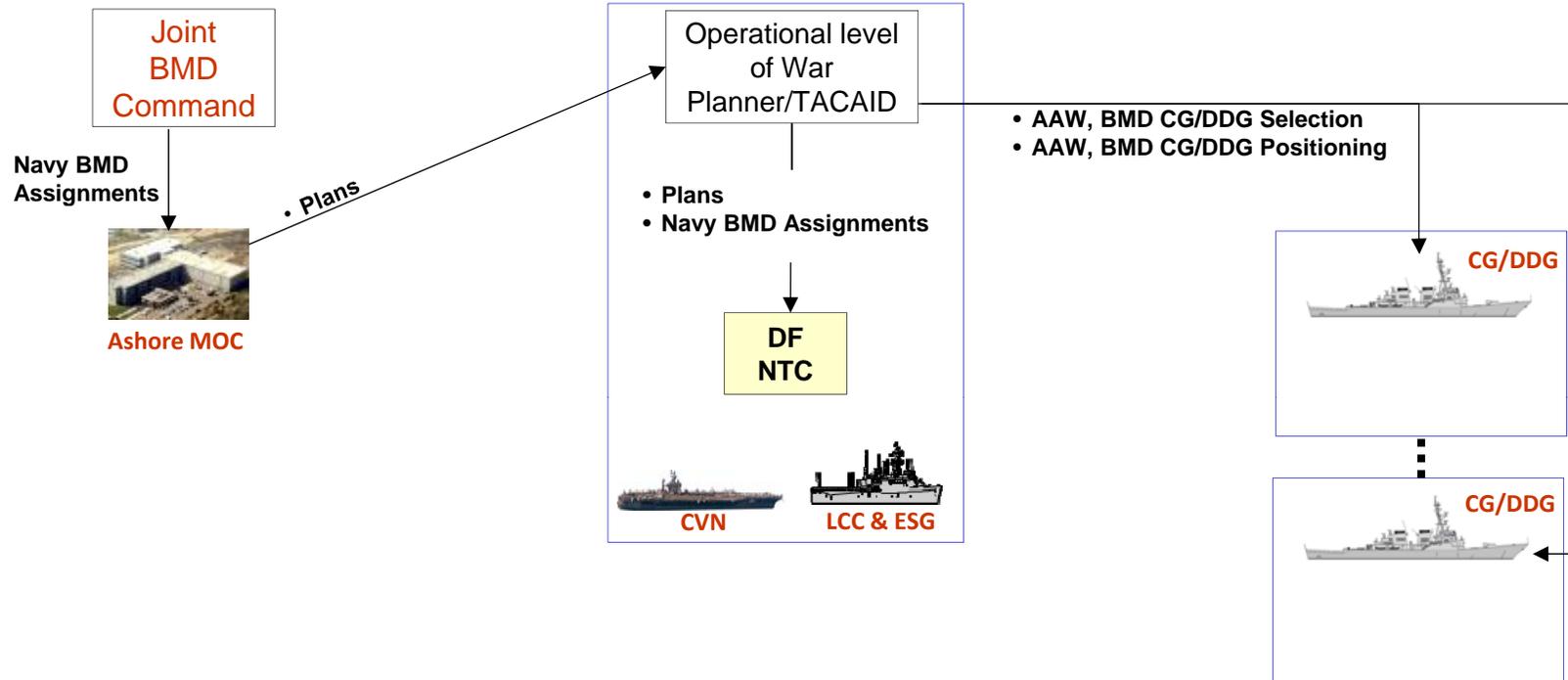
Planning
today

IAMD Scenario Use Case Examples



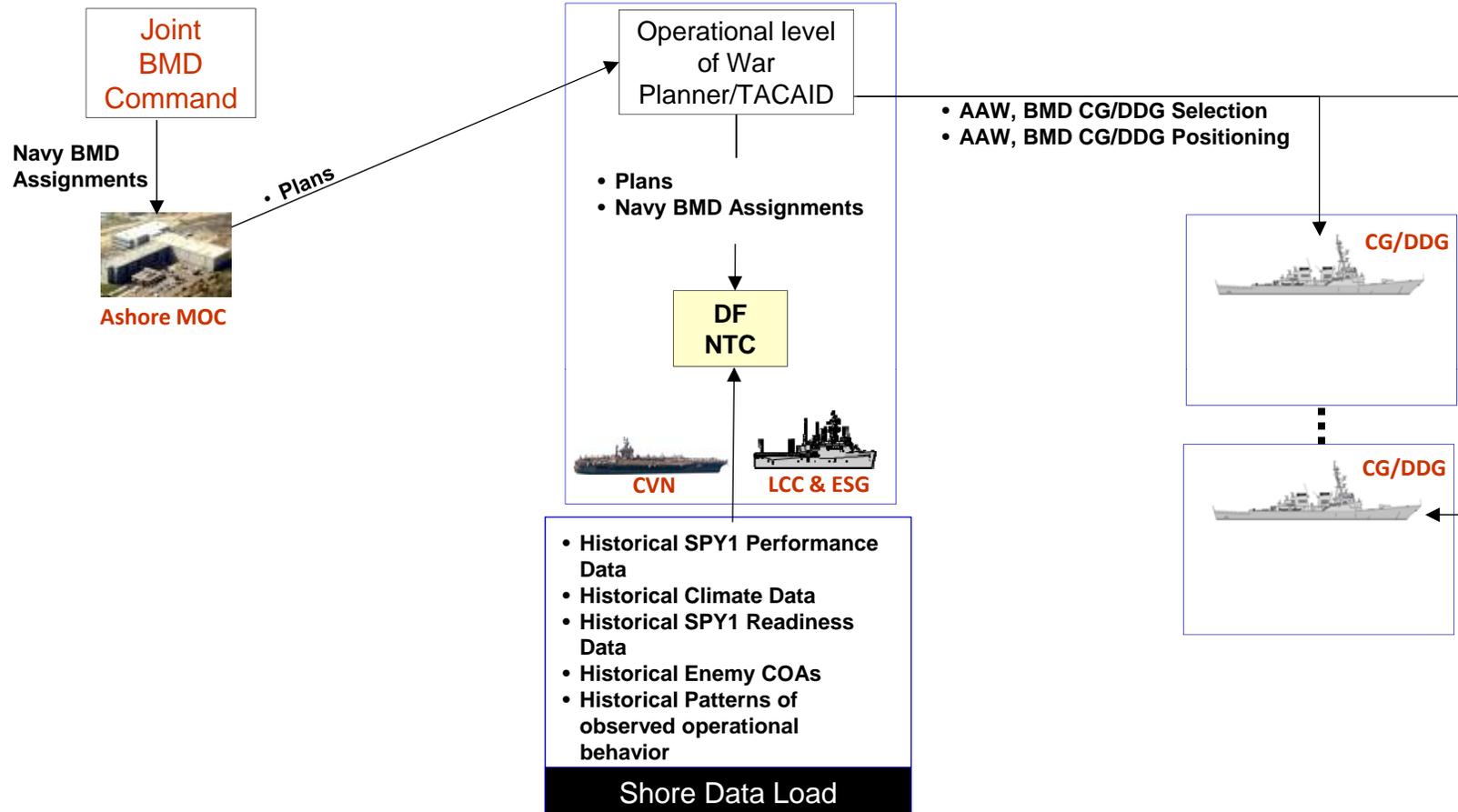
NTC
planning
scenario

IAMD Scenario Use Case Examples



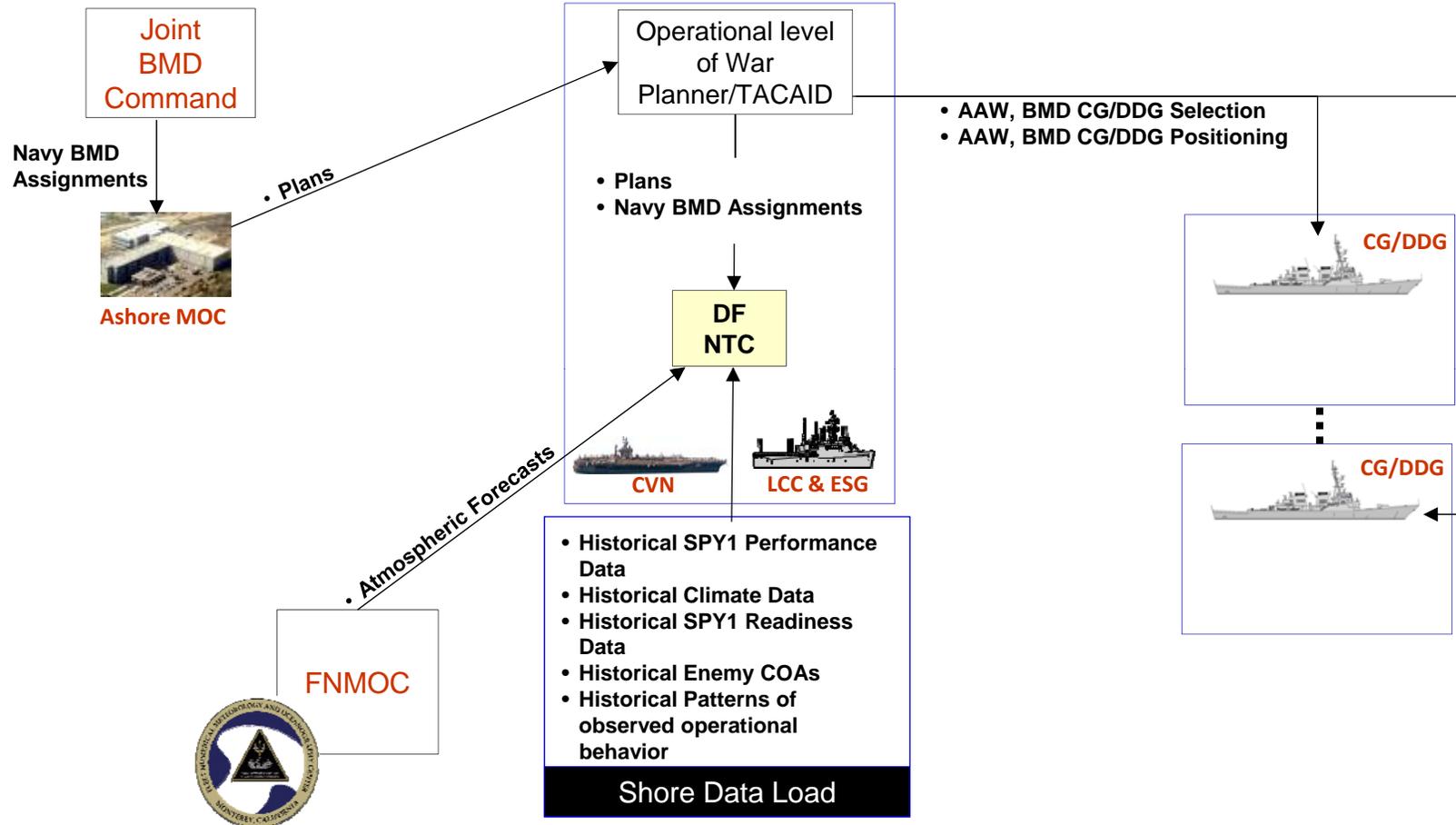
NTC
planning
scenario

IAMD Scenario Use Case Examples



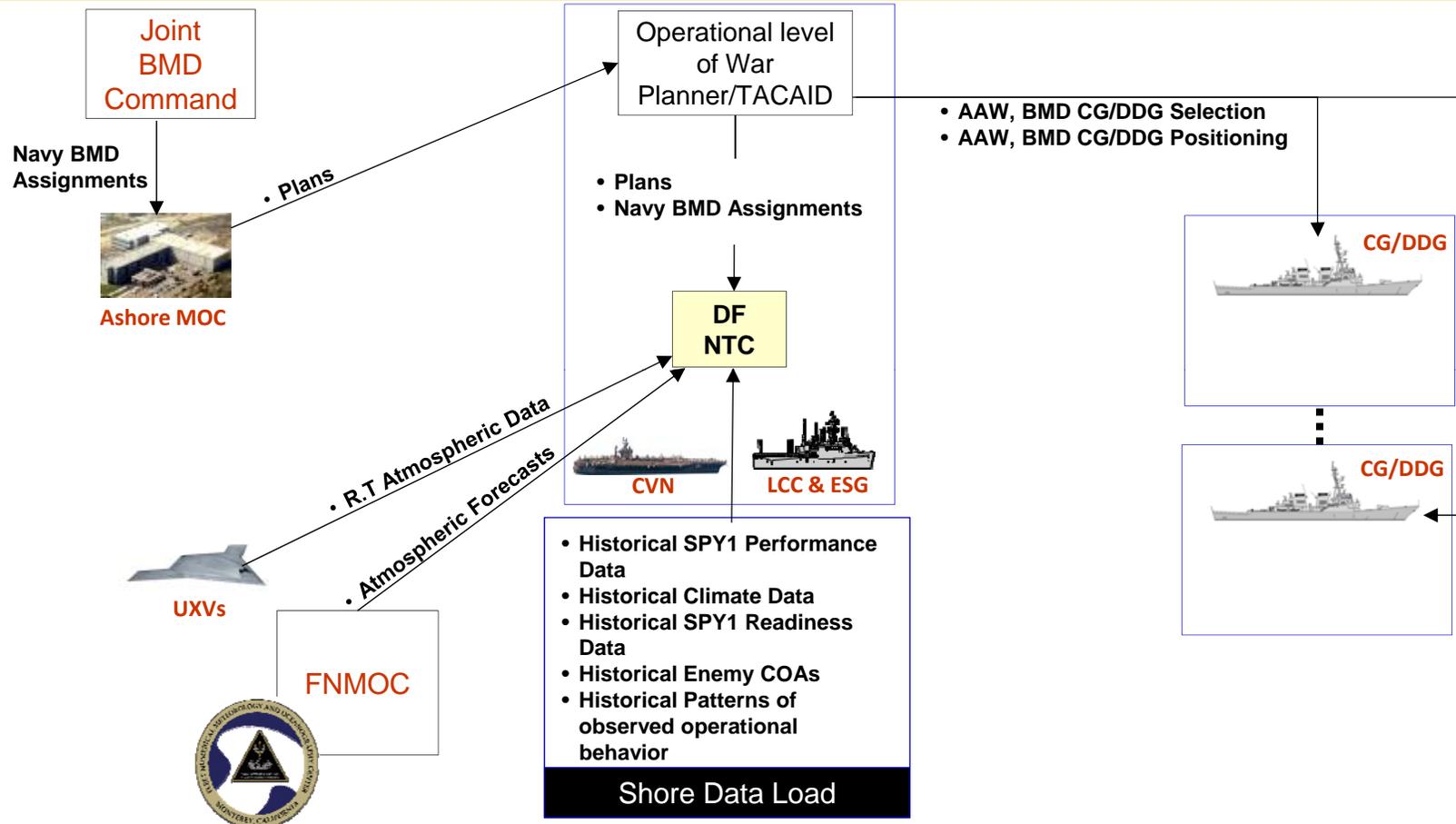
NTC
planning
scenario

IAMD Scenario Use Case Examples



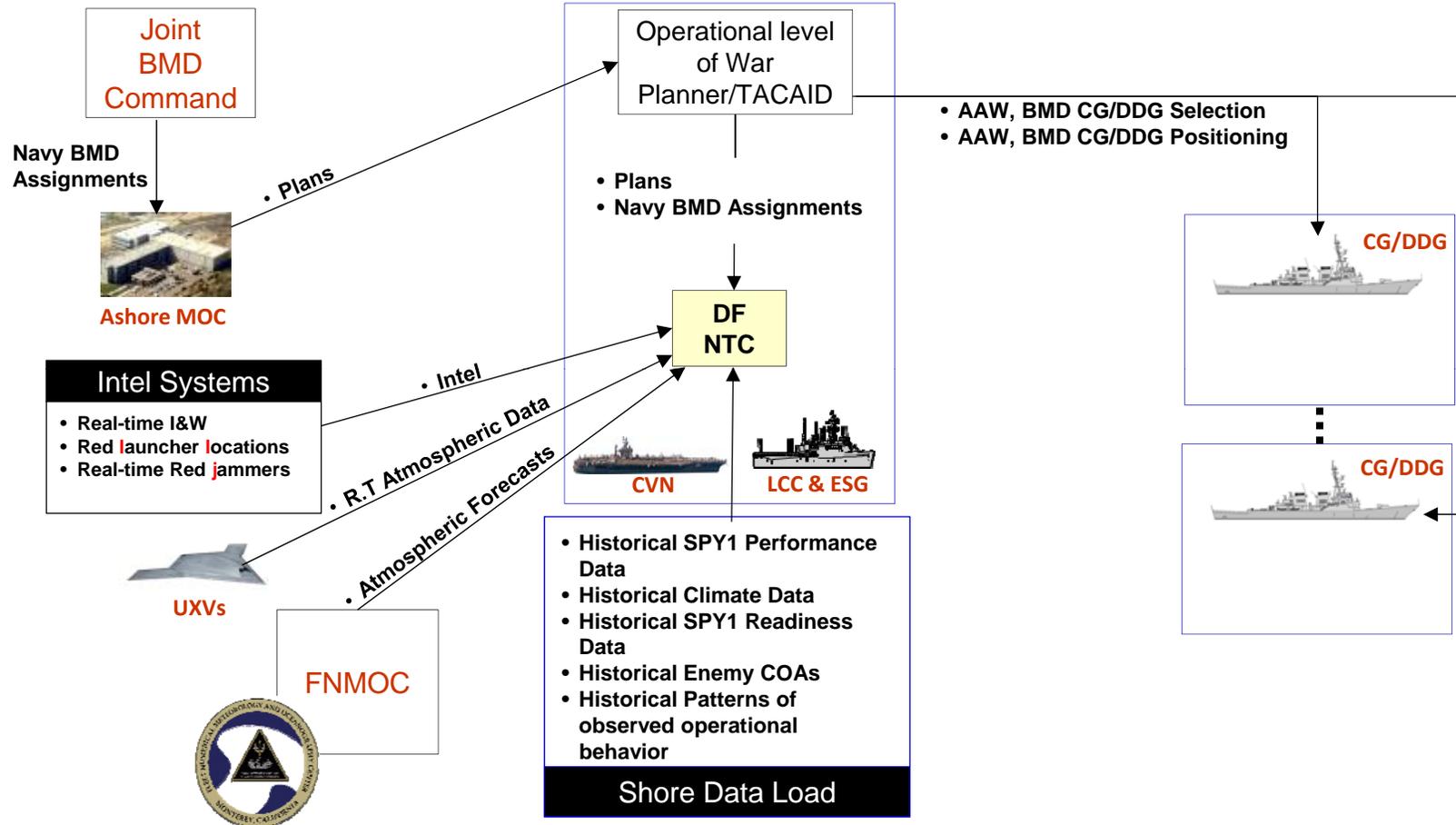
NTC
planning
scenario

IAMD Scenario Use Case Examples



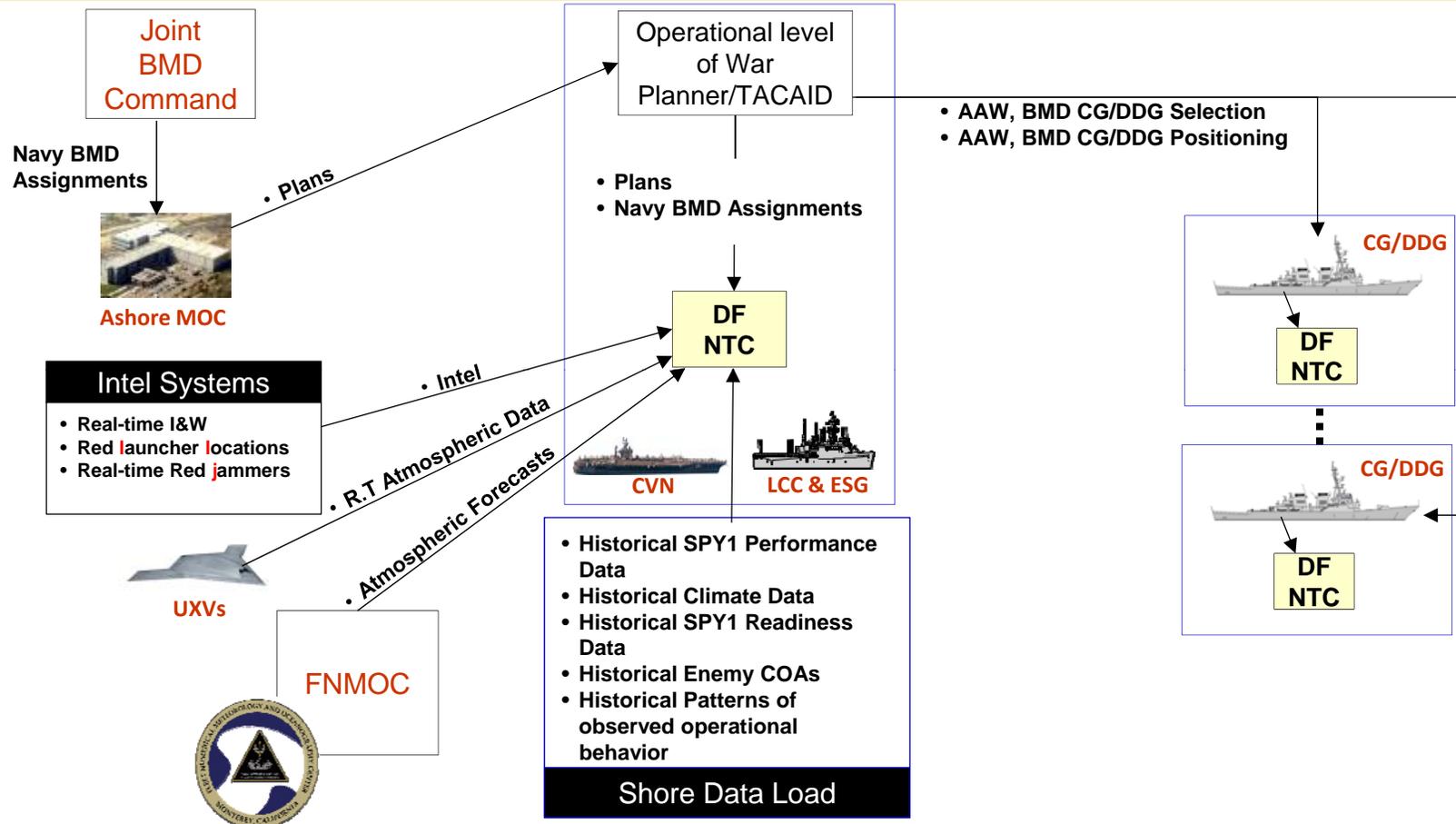
NTC
planning
scenario

IAMD Scenario Use Case Examples



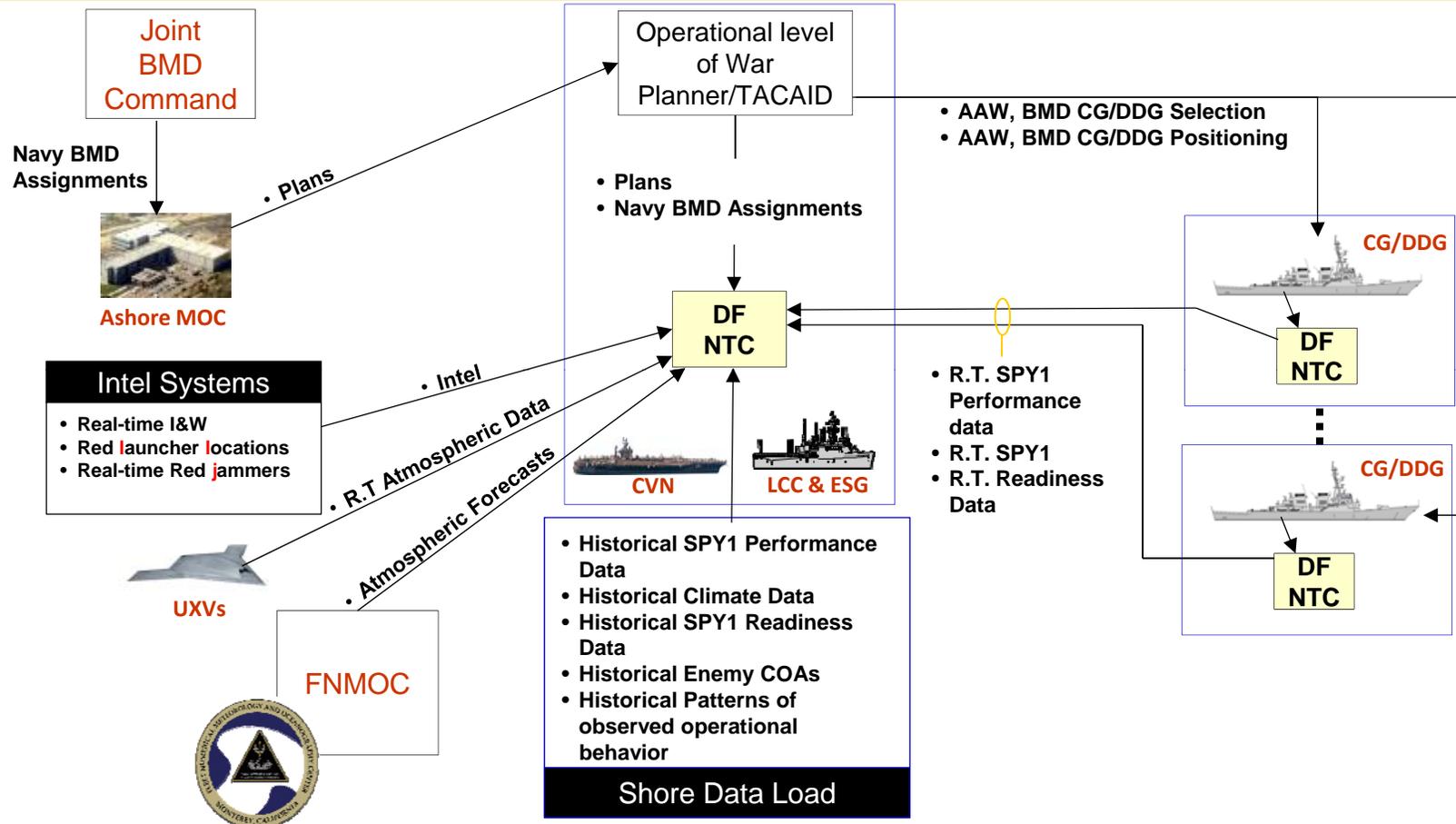
NTC
planning
scenario

IAMD Scenario Use Case Examples



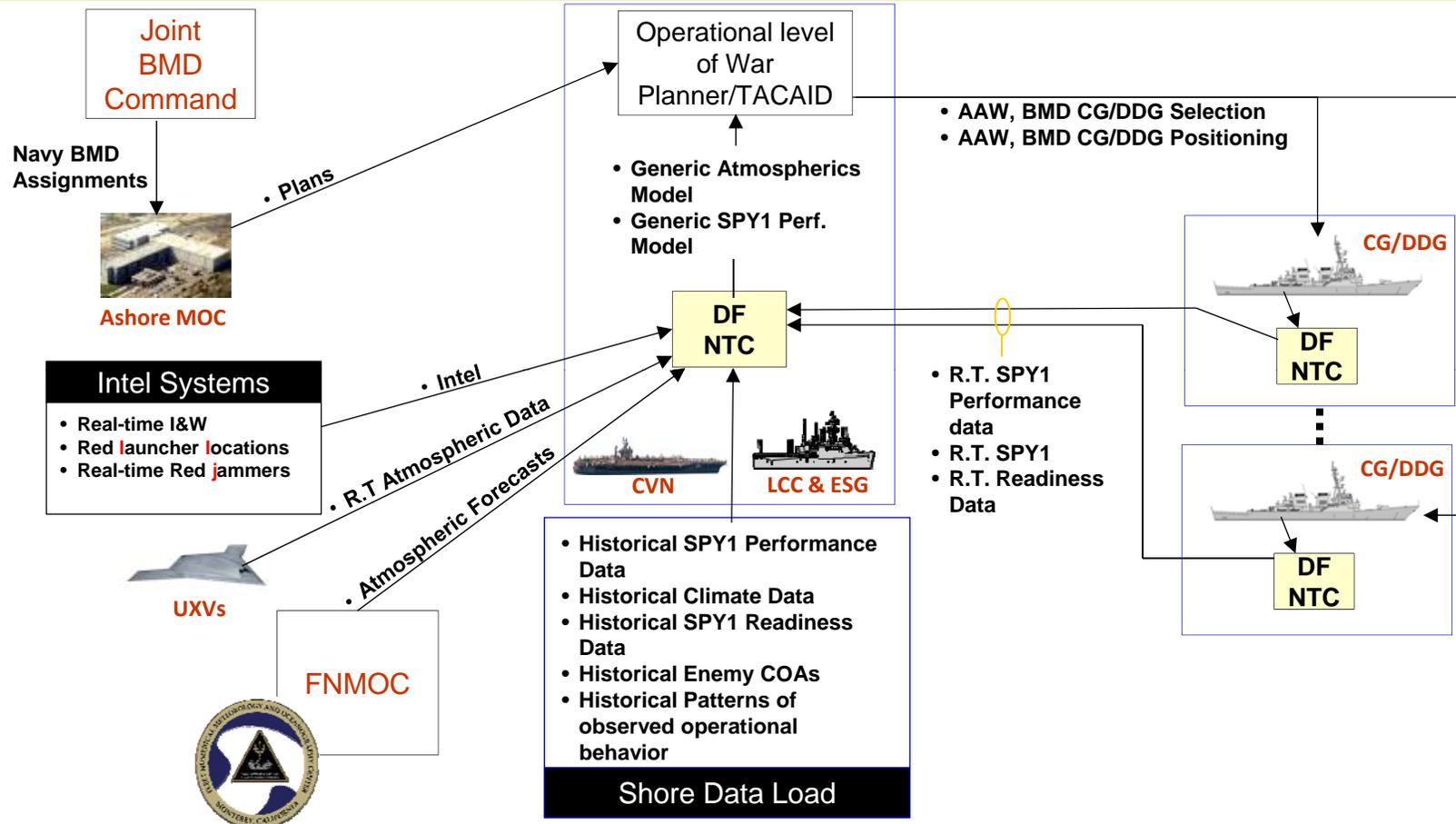
NTC
planning
scenario

IAMD Scenario Use Case Examples



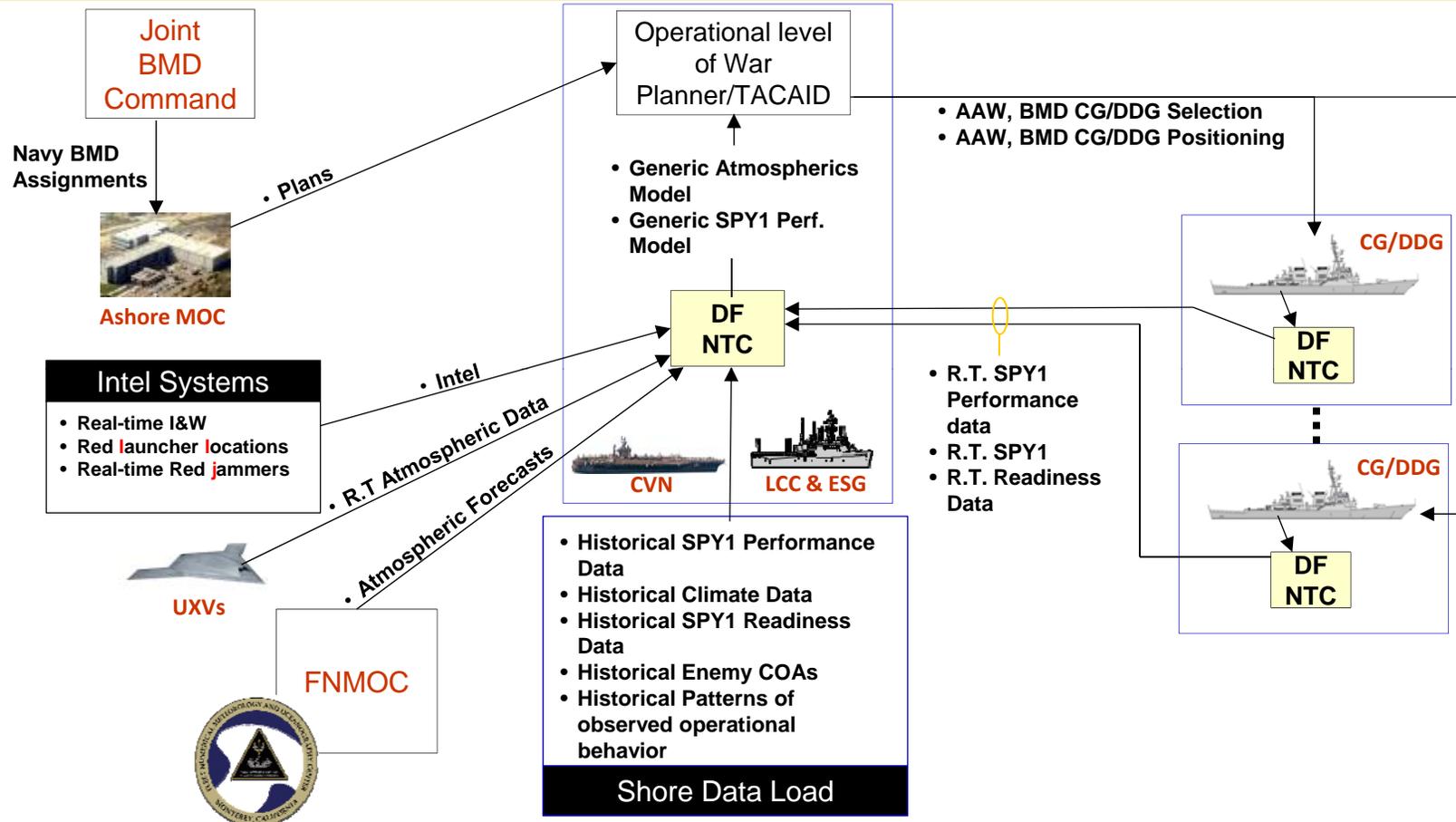
NTC
planning
scenario

IAMD Scenario Use Case Examples



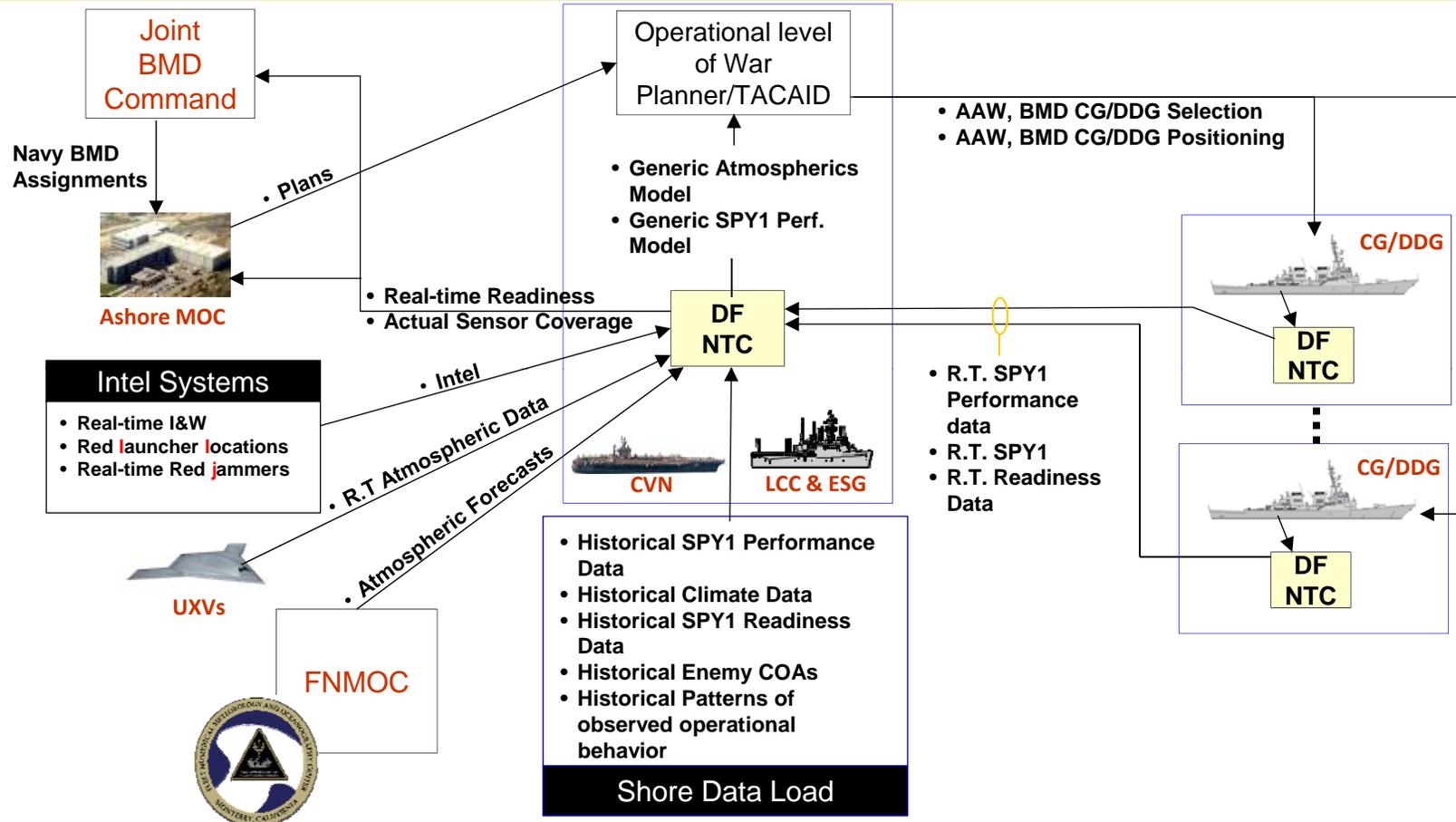
NTC
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IAMD Scenario Use Case Examples



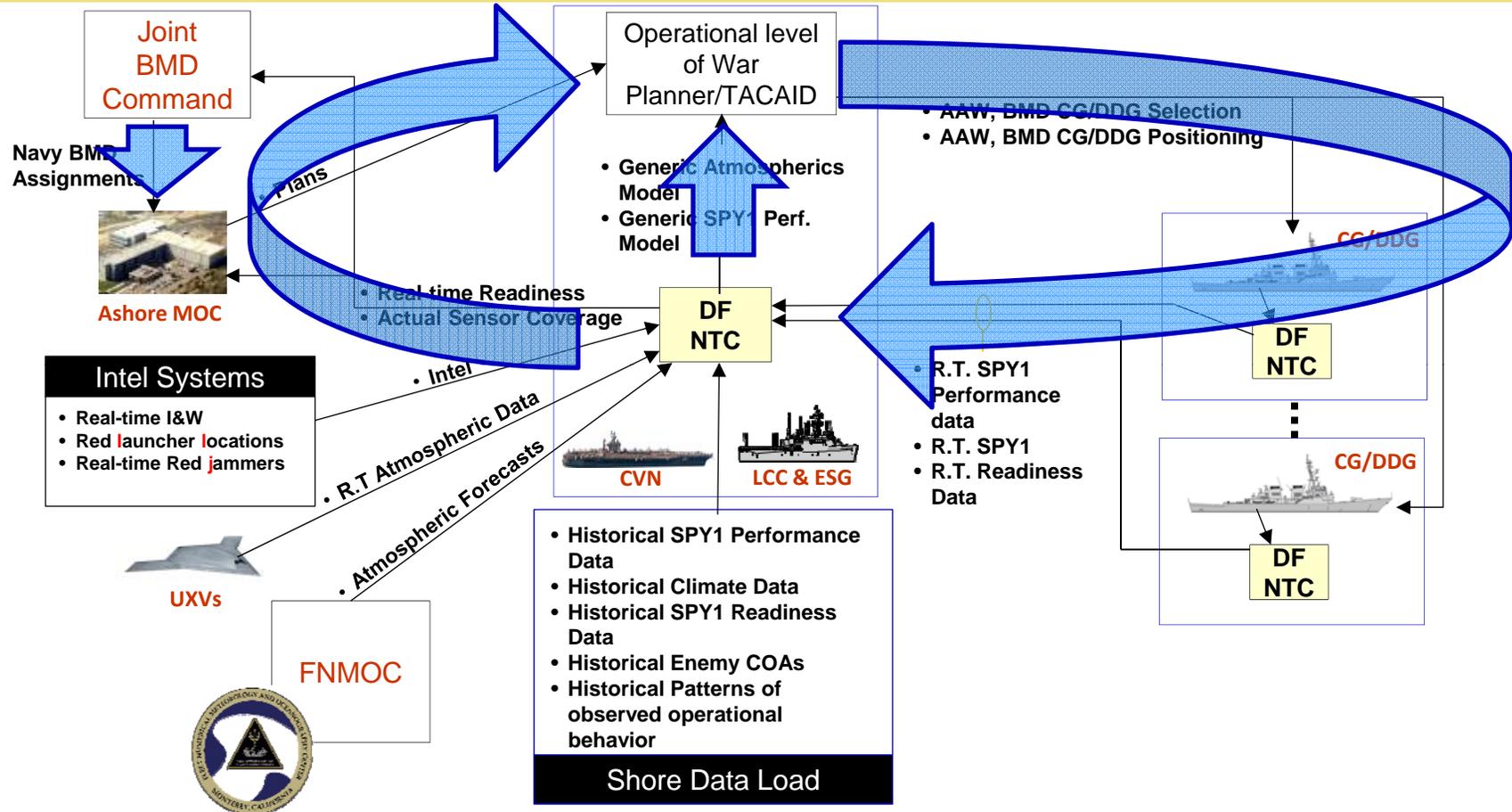
Feedback loop supports replan at multiple levels

IAMD Scenario Use Case Examples



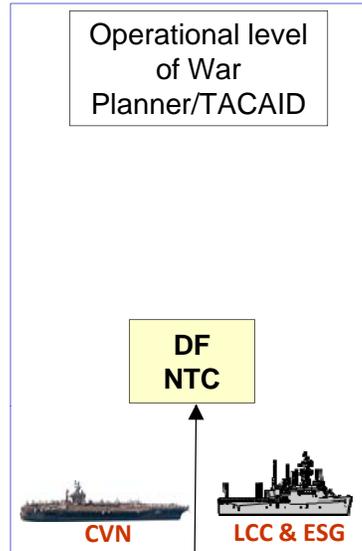
Feedback loop supports replan at multiple levels

IAMD Scenario Use Case Examples



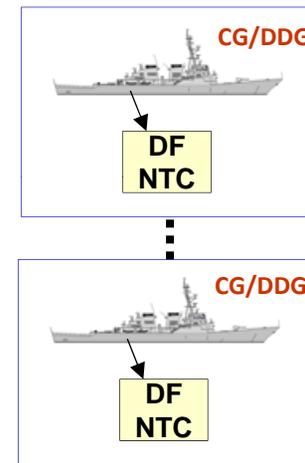
Feedback loop supports replan at multiple levels

IAMD Scenario Use Case Examples



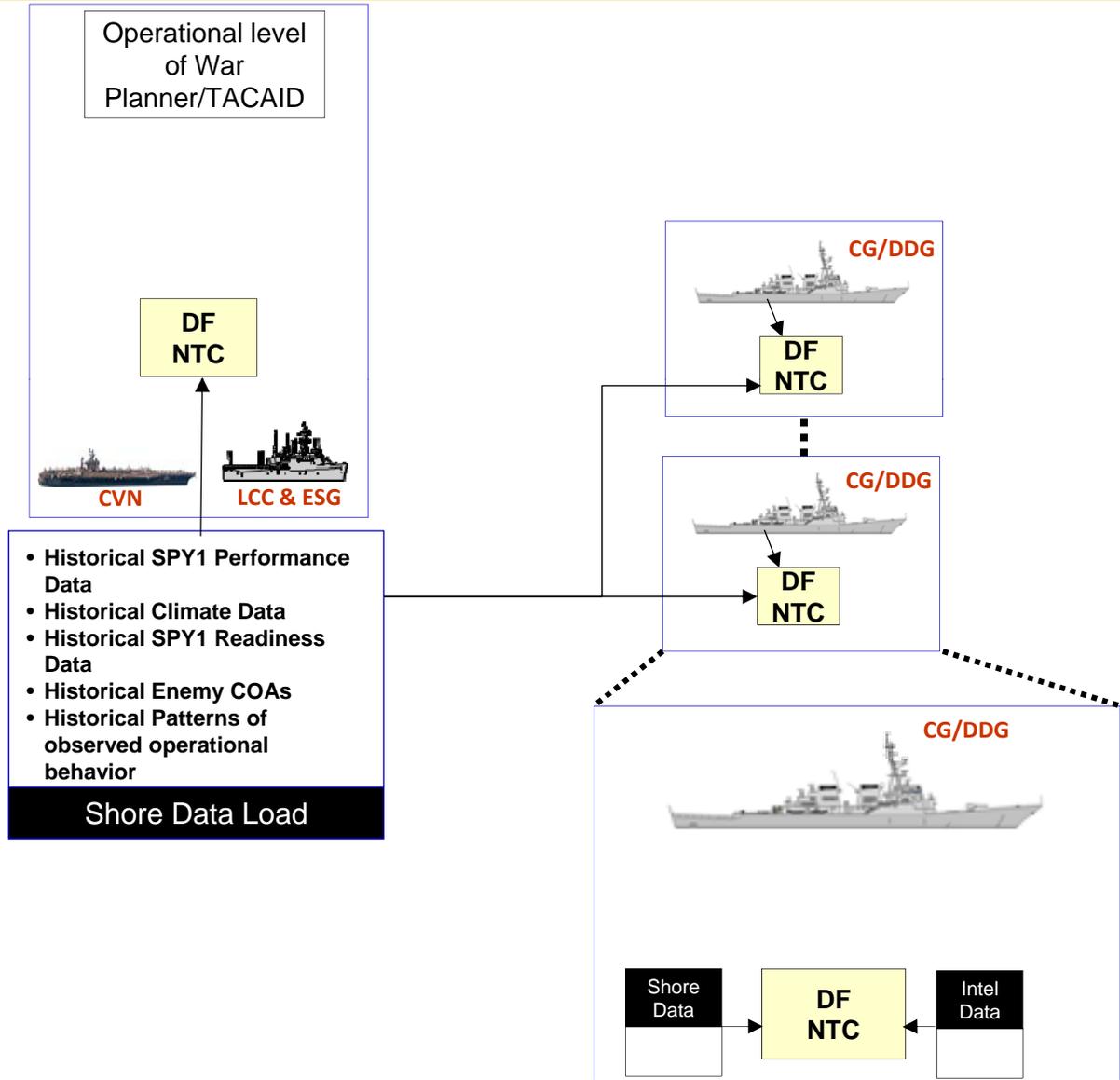
- Historical SPY1 Performance Data
- Historical Climate Data
- Historical SPY1 Readiness Data
- Historical Enemy COAs
- Historical Patterns of observed operational behavior

Shore Data Load



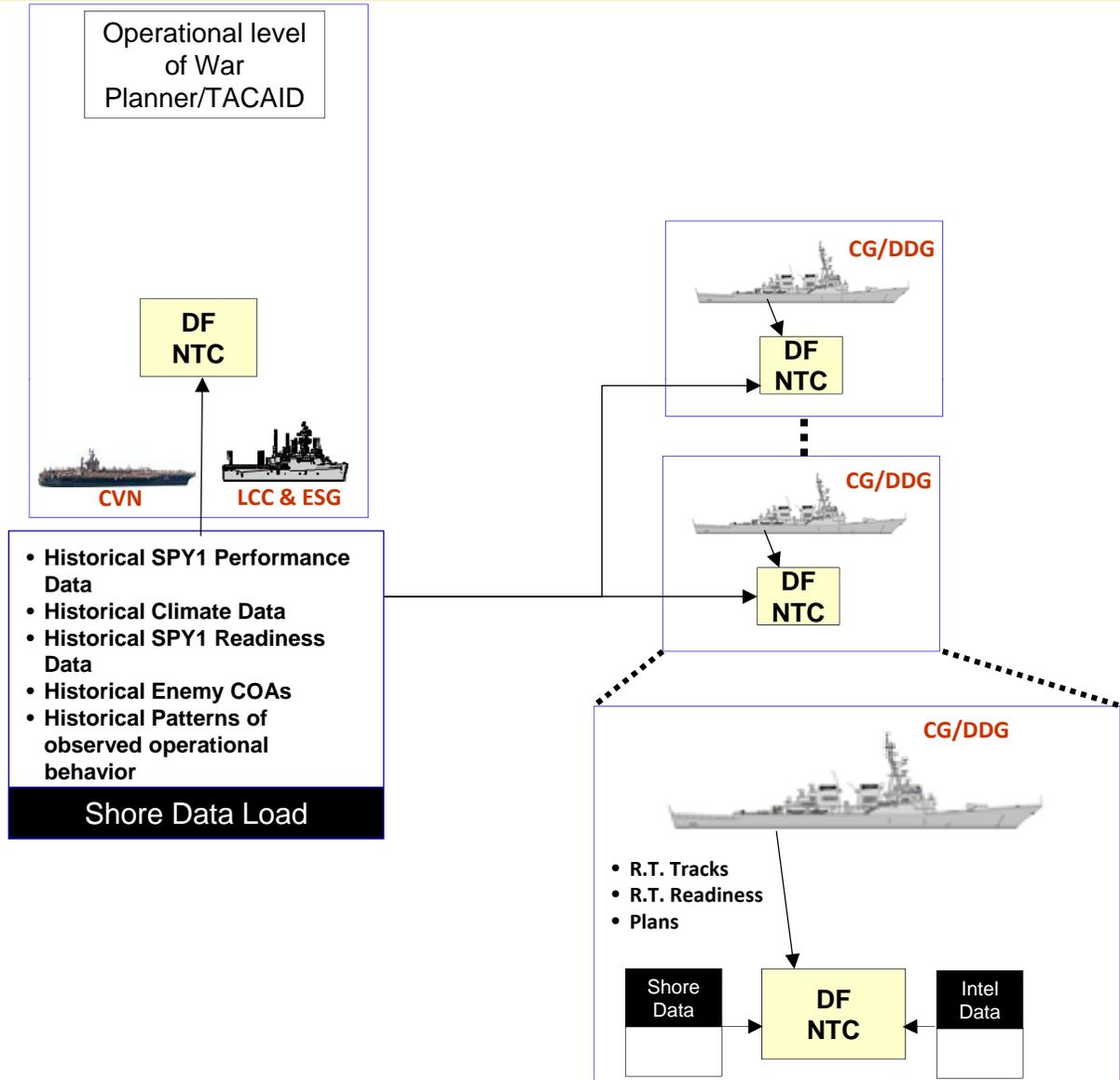
NTC
execution
scenario

IAMD Scenario Use Case Examples



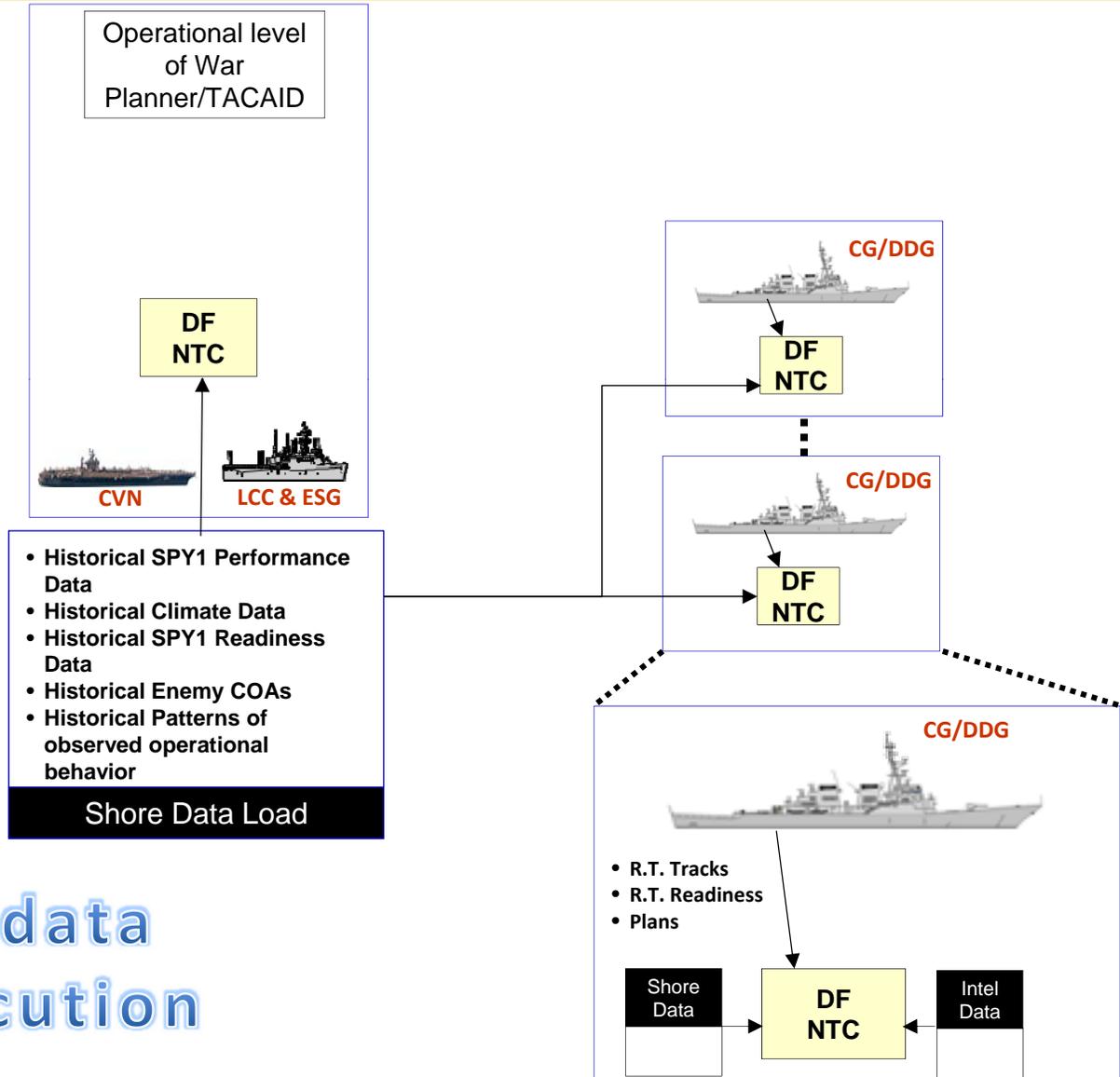
NTC
execution
scenario

IAMD Scenario Use Case Examples



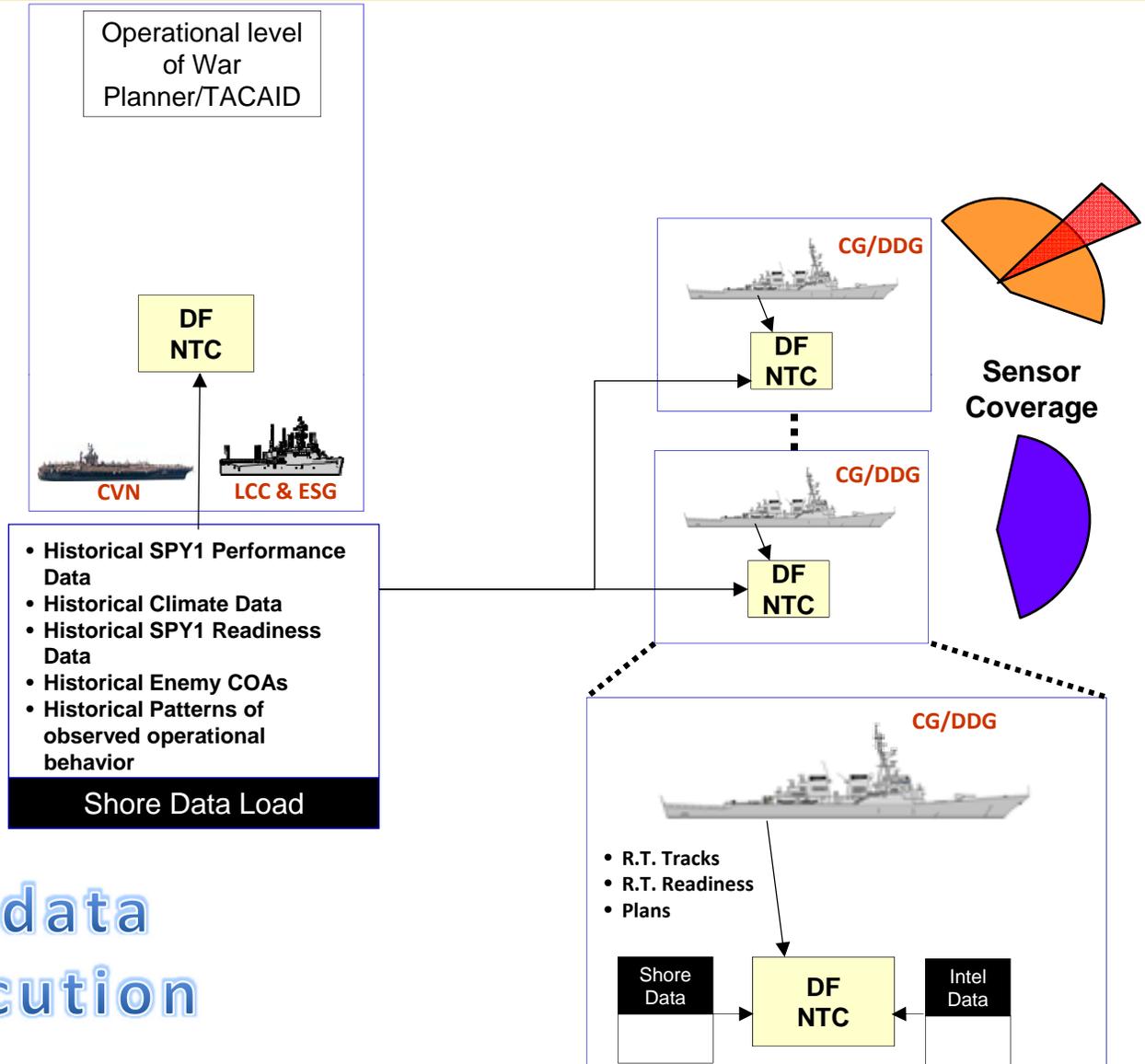
NTC
execution
scenario

IAMD Scenario Use Case Examples



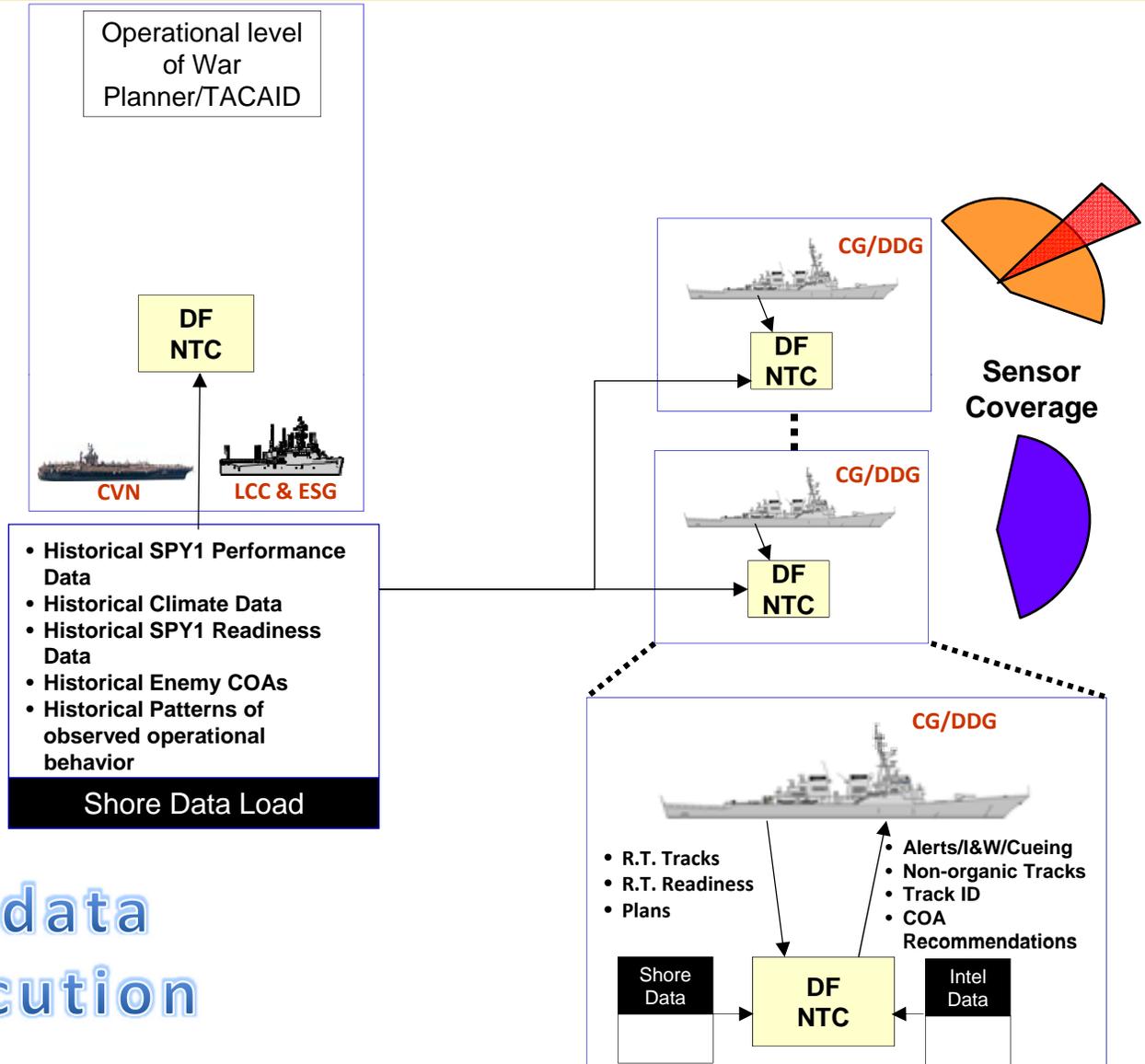
Analytic-driven data
can initiate execution
changes

IAMD Scenario Use Case Examples



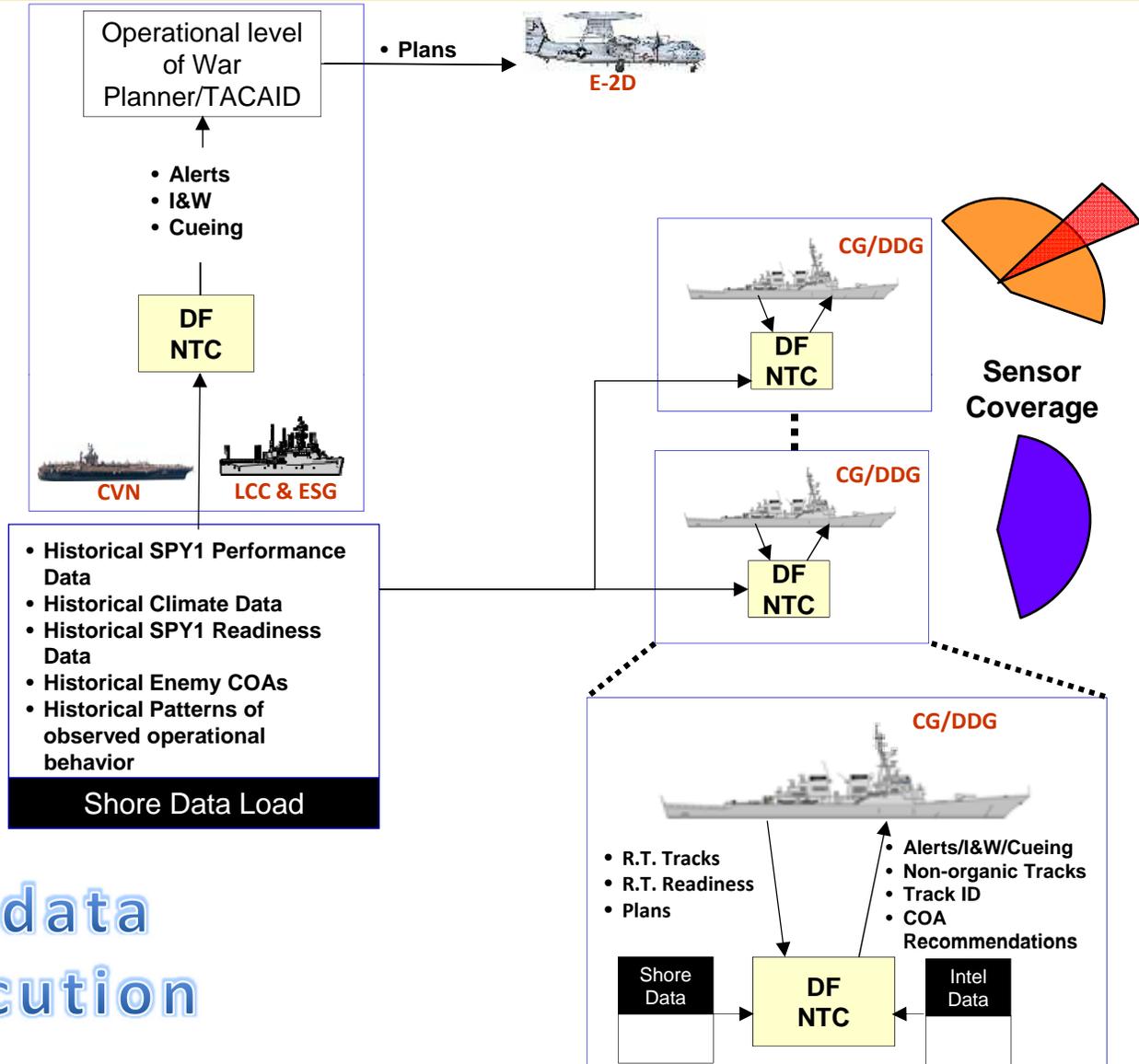
Analytic-driven data
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IAMD Scenario Use Case Examples



Analytic-driven data
can initiate execution
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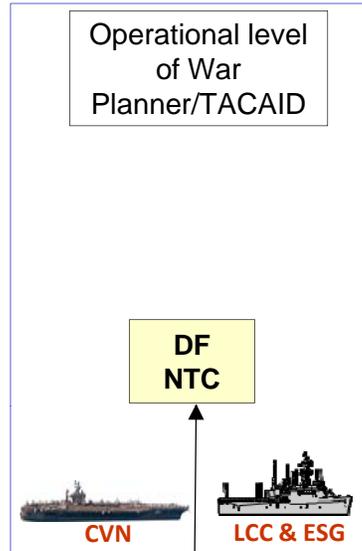
IAMD Scenario Use Case Examples



Analytic-driven data
can initiate execution
changes

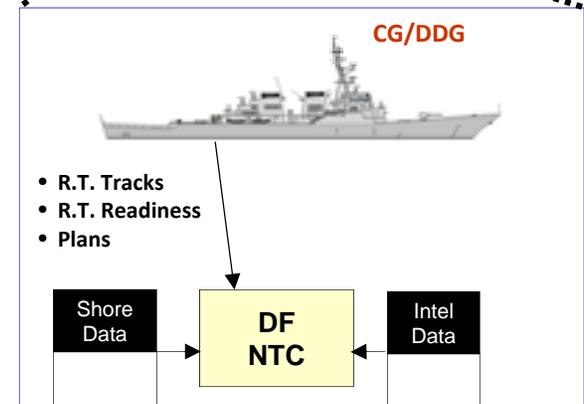
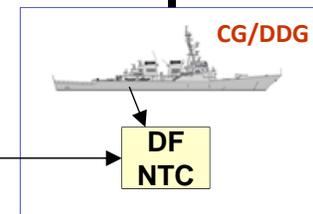
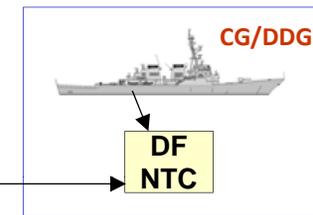
IAMD Scenario Use Case Examples

Shore
Sites



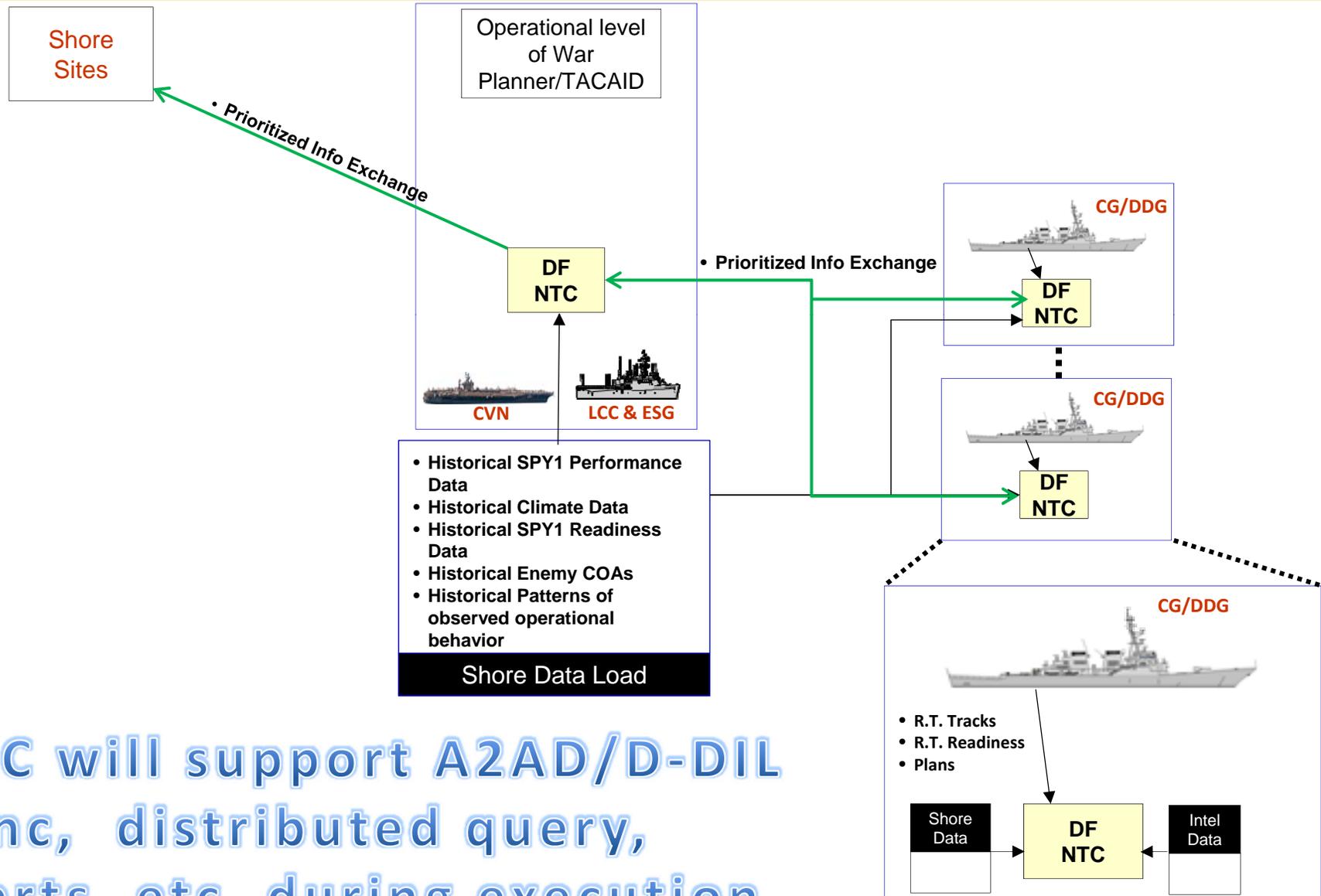
- Historical SPY1 Performance Data
- Historical Climate Data
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Shore Data Load



NTC will support A2AD/D-DIL Sync, distributed query, alerts, etc. during execution

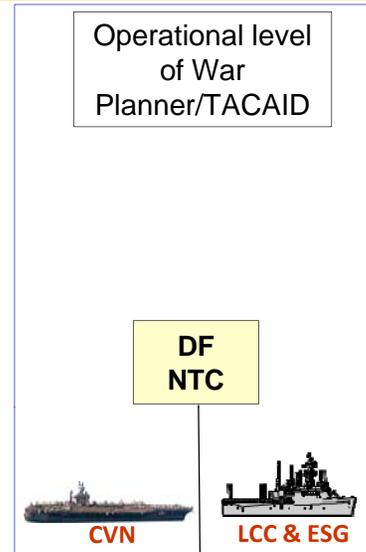
IAMD Scenario Use Case Examples



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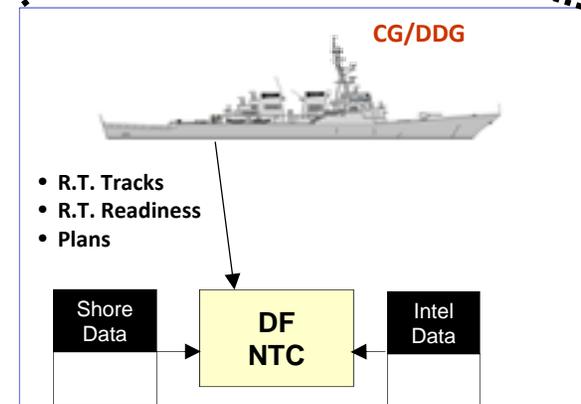
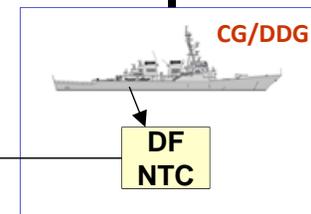
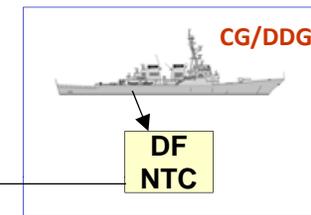
IAMD Scenario Use Case Examples

Shore
Sites



- Historical SPY1 Performance Data
- Historical Climate Data
- Historical SPY1 Readiness Data
- Historical Enemy COAs
- Historical Patterns of observed operational behavior

Shore Data Repository



NTC will support bulk
offload of collected data
at end of deployment

IAMD Data Science Challenges

- **IAMD systems produce large volumes of data**
 - What should be ingested?
 - Where should filtering occur?
 - What processing is needed inside combat system?
 - How should the data should be indexed?
 - How should data be retained and for how long?
 - How will data be shared in an Anti-Access Area Denial (A2AD)/Disrupted, Disconnected, Intermittent and Limited bandwidth (D-DIL) environment?
- **IAMD will require diverse analytics and data sets**
 - Weather and sensor performance prediction versus track anomaly prediction
 - Track example: Update rates range from very fast to very slow
 - Many times per second for sensor data
 - 10s of times per minute for tracked entities
 - Minutes, hours, or days for untracked entities
 - Cross-warfare area data sharing: What data is available? Where else can IAMD data be used?
- **Real-time Analytics**
 - Analytics may need to respond within seconds (or less) upon updates to entity data
 - Indications and warnings
 - How are analytics prioritized (e.g., I&W higher priority than planning)?

Part #8

Security Thrust



Data Cloud Security and Integrity: Challenges

- **Adapt/improve technologies or techniques to protect the NTC by identifying, isolating, and/or removing adversary cyber actors from this infrastructure**
- **Develop analogous capabilities or new approaches for the Naval Big Data Ecosystem to assure the integrity and accuracy of the underlying data (which consists of many different types / formats) used to make decisions**
- **Integrate these capabilities into advanced cyber analytics / applications that leverage the NTC analytic environment while being simple enough for a sailor to operate**

The migration to the NTC provides an opportunity to give the warfighter the flexibility to fight through an adversary's attempts to use cyber to degrade or deny the decision making capabilities of naval commanders



Combat System Objective Architecture and DF-NTC Perspective

***Kathy Emery
PEO IWS D1
kathy.emery@navy.mil***



Program Executive Office Integrated Warfare Systems

Aegis Combat Systems Integration into DDG 151 and CG 47 class ships



BFTT
CPS

CDS

AMDR Integration



NIFC-CA

SFSE

FTAMD

Open Architecture

MIPS III

ECIDIS-M

CEC



MK 34 GWS: Countries

• Radars: 1 Country
• Ammunition: 17 Countries

• WSN-7/9: 4 Countries
• NFCS: 1 Country

CEC: 1 Country

LCS 1 & LCS 2 Combat Systems Variant Integration

DDG 1000 Combat Systems (TSCE) Integration

• SQQ-89: 2 Countries

BFTT: 1 Country

SM-1/SM-2: 15 Countries

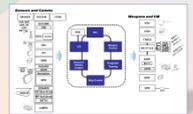
CIWS: 9 Countries

MK 41 VLS: 8 Countries

LCS 2

LCS 1

DGG 1000



SSDS Combat Systems Integration in the following classes:



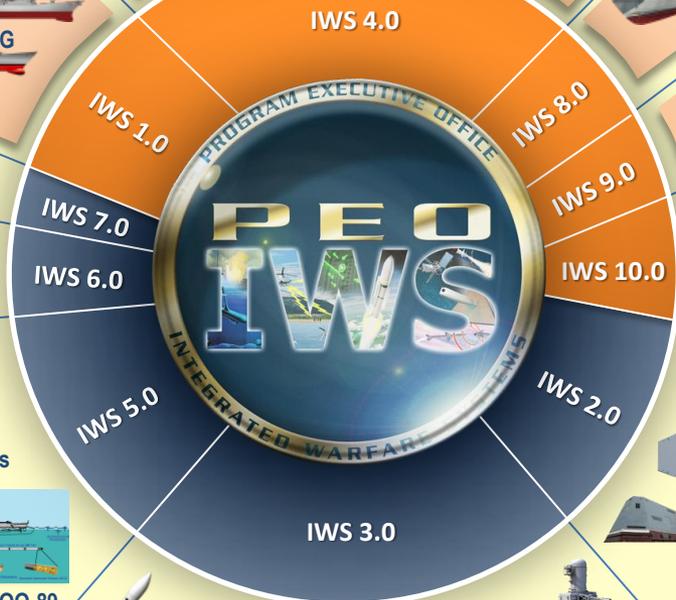
CVN

LHD

LSD

LHA

LPD



Sub Arctic Warfare Dev.

ASW Advanced Dev.

MK-32

LCS Mission Modules

- 146 – Program & Projects
- 3 – ACAT I
- 5 – ACAT II
- 2 – ACAT III
- 4 – ACAT IV
- 9 – R&D
- 39 – Inactive
- 84 – Non ACAT

CADRT

USW DSS

CV-TSC

SDRW/SRD /SCD

Surface ASW Systems Imp.

UQN-4A

WQC-2A/6

SQS-56

SEARAM

• SQQ-89

SM-2

Bik IIIB/ BLK IV

SM-6

ESSM

RIM-7/ MK57 NSSMS

Griffin

MK 45

MK 75 76mm

MK 57 VLS

LRLAP

CIWS

MK 38

RAM BLK 1/2

AGS

NFCS

MK 46 33mm

AMDR

SPY-1A/B/D

SPY-3

SPS-49

SPS-55

SPA-25

BPS-15

MMS

AN/SLQ-32

AN/SPQ-9B

SPS-40

SPS-64

SPS-67/73

SPQ-14/15

SEWIP

NULKA

SPS-67/73

WLR-1

AOEW DDE

SSQ-82

AUSPAR

Integrated Combat Systems Major Program Manager

Product Major Program Managers

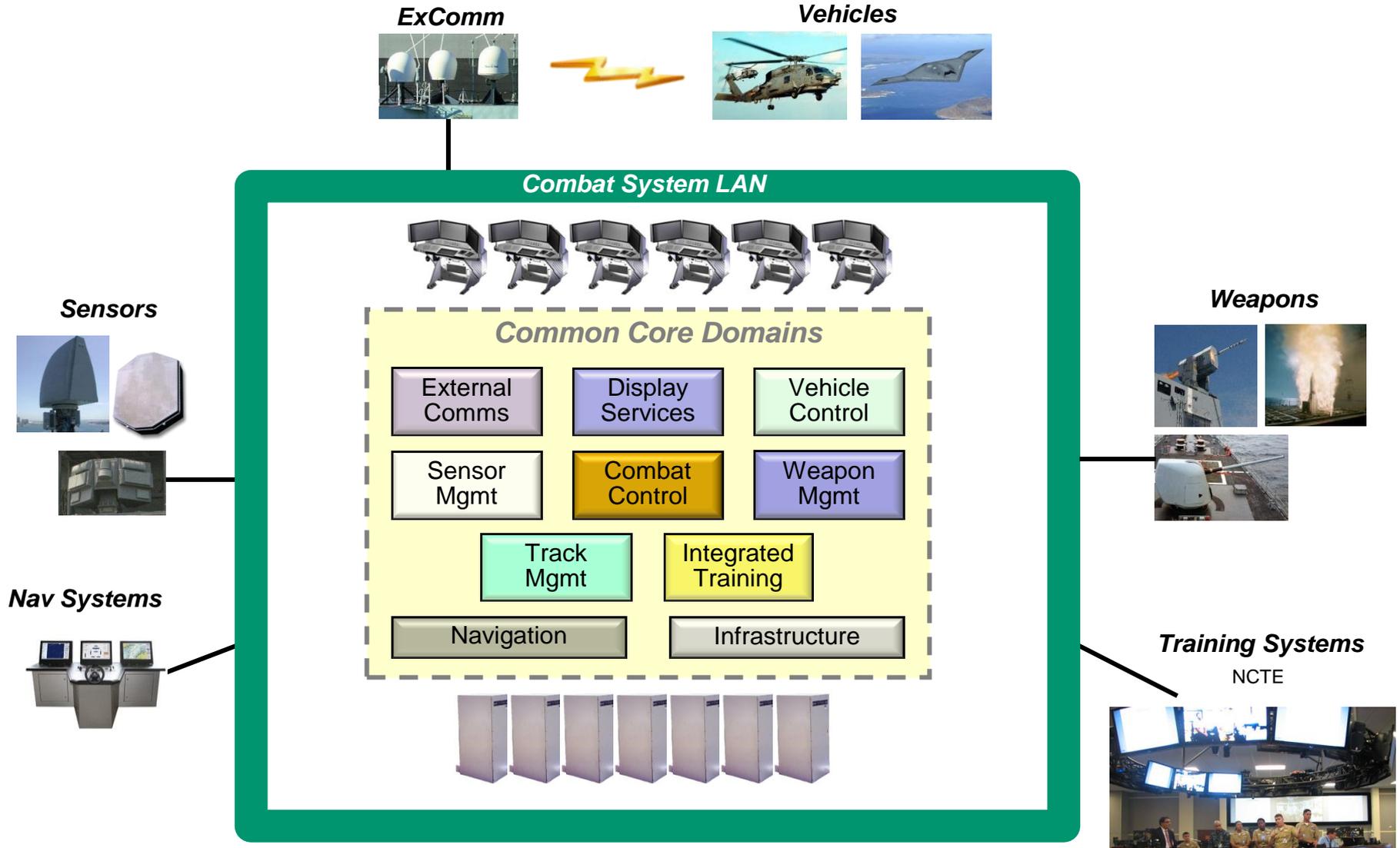
PEO IWS develops, procures and delivers Integrated Warfighting Solutions for Surface Ships



PEO IWS Combat System Strategy

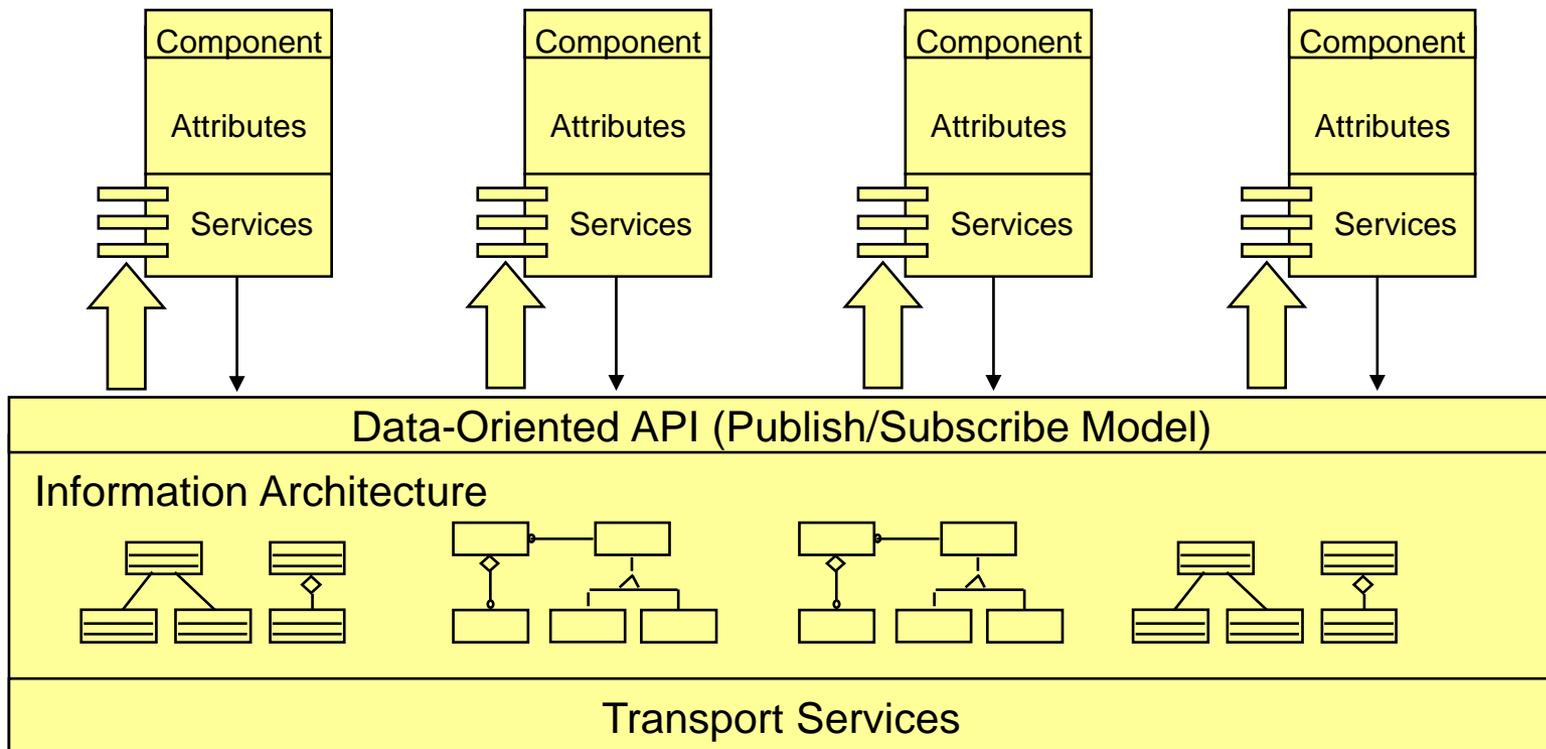
- Enhance mission capability across Surface Fleet with faster and more affordable upgrades that are interoperable and pace the threat
 - Decouple combat system acquisition from ship programs
 - Install combat system-wide network-based COTS computing environment (hardware and software)
 - Define a common objective combat system architecture and associated network-based information exchange standards
 - Standardized interfaces support commonality across ship classes
 - Flexible “information bus” simplifies integration of new CS capability
 - Reduce combat system variants and apply a product line approach for new development that aligns with objective architecture
 - Focus on fielding end-to-end capabilities vs. systems

Combat System Objective Architecture



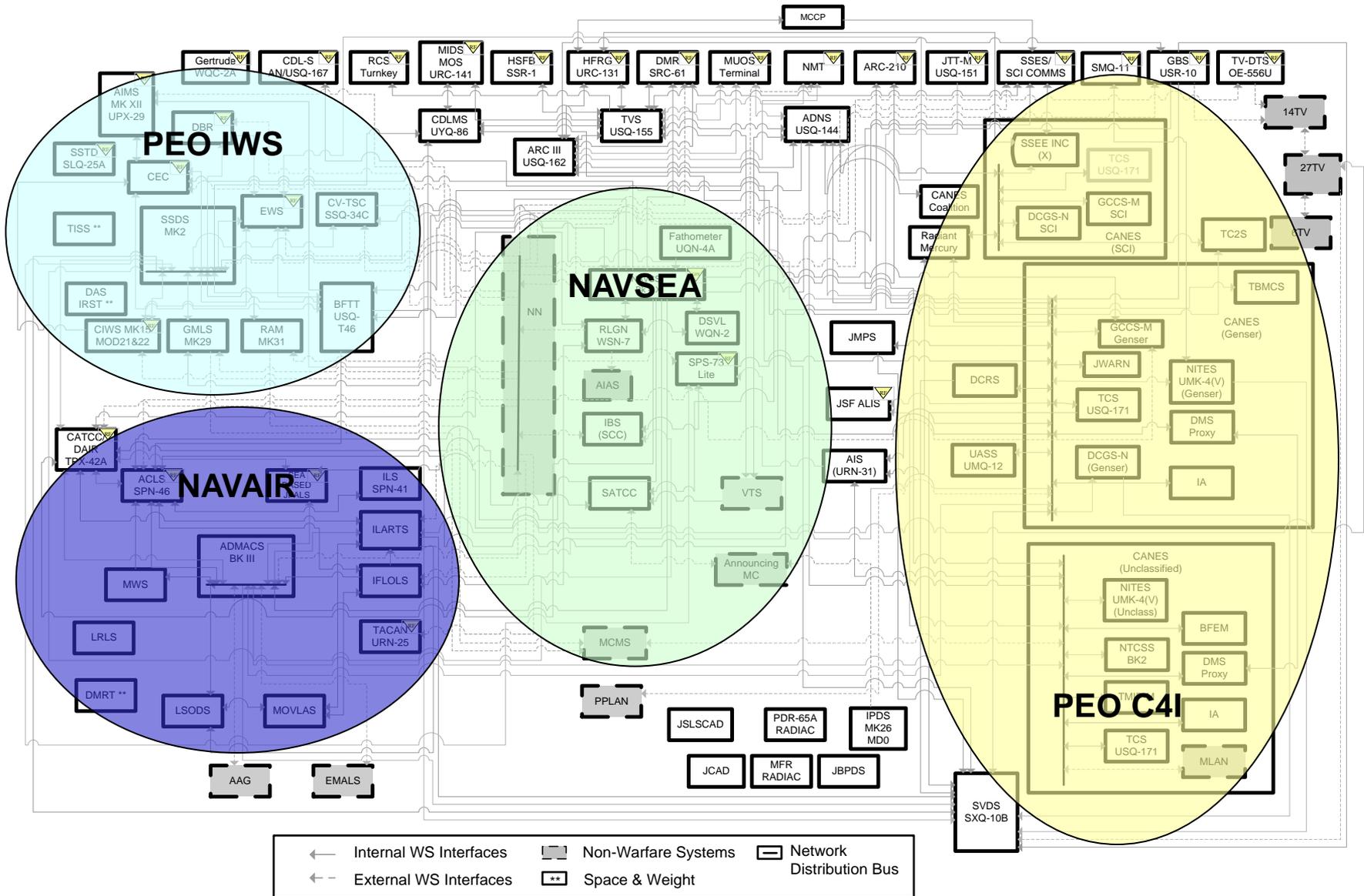
Information-Oriented Architecture Is Key to Defining Reusable, Extensible Components

- Define a common data model and information standard
- Component-to-network interfaces, not component-to-component
- Publish information for any authorized subscriber to access
- Producers of information don't have to be aware of consumers
- Objective architecture defines interfaces for extensibility and reuse



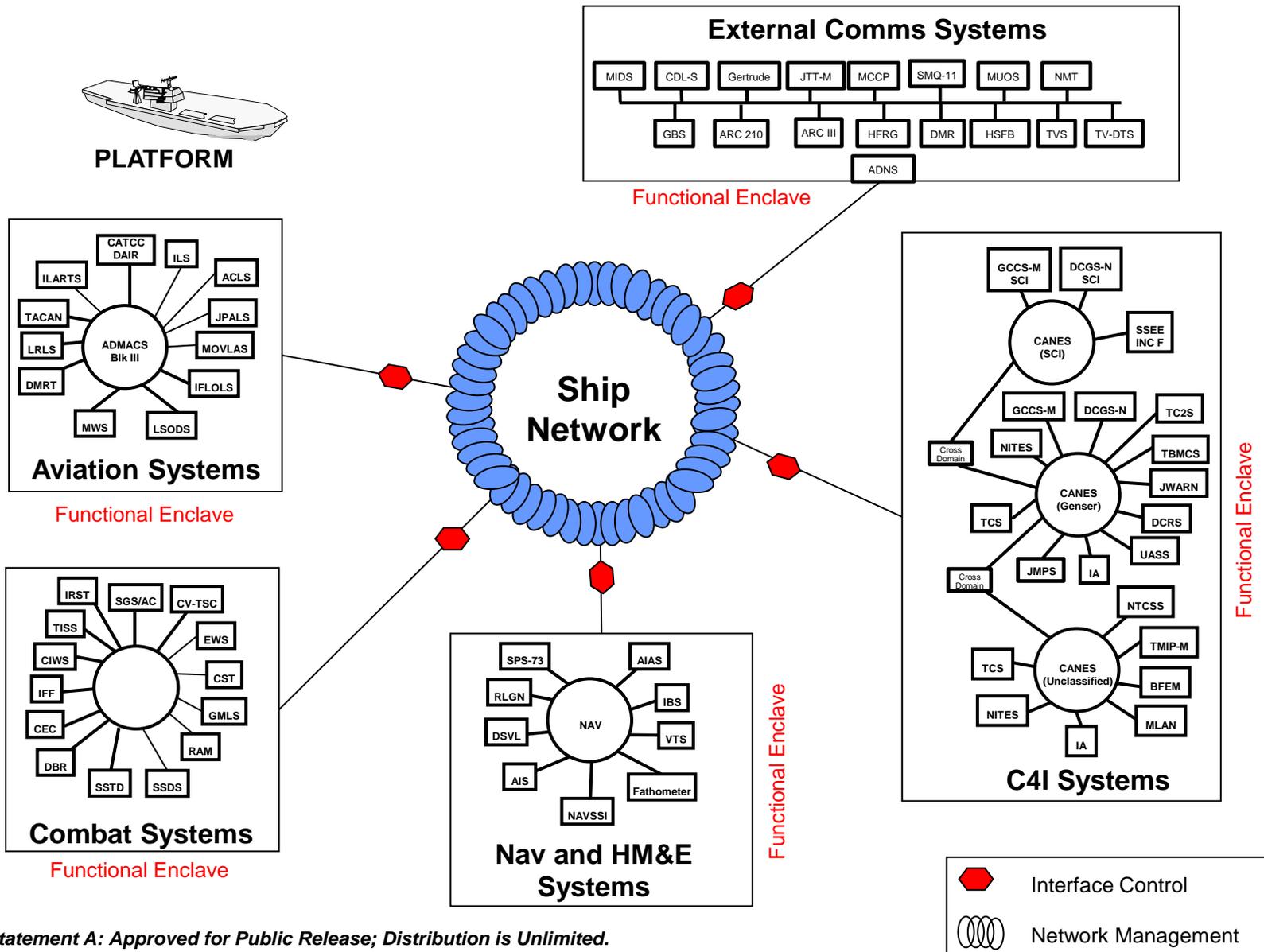
Today's Shipboard Environment

(Direct interfaces, weak inter-enclave integration)

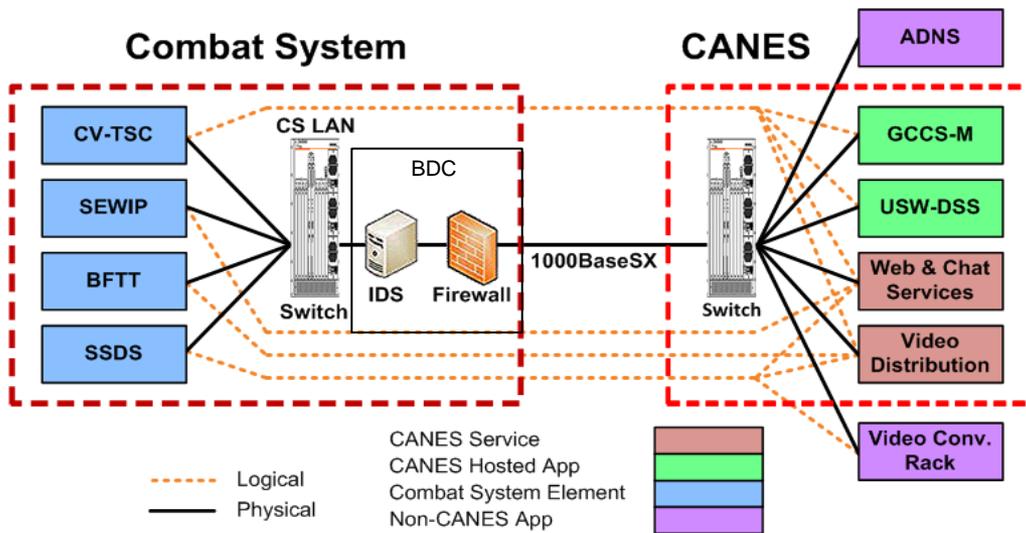


Future Shipboard Environment

(Network interfaces, significant cross-enclave integration, IA defense in depth)



Gateway and Boundary Defense Capability (BDC)

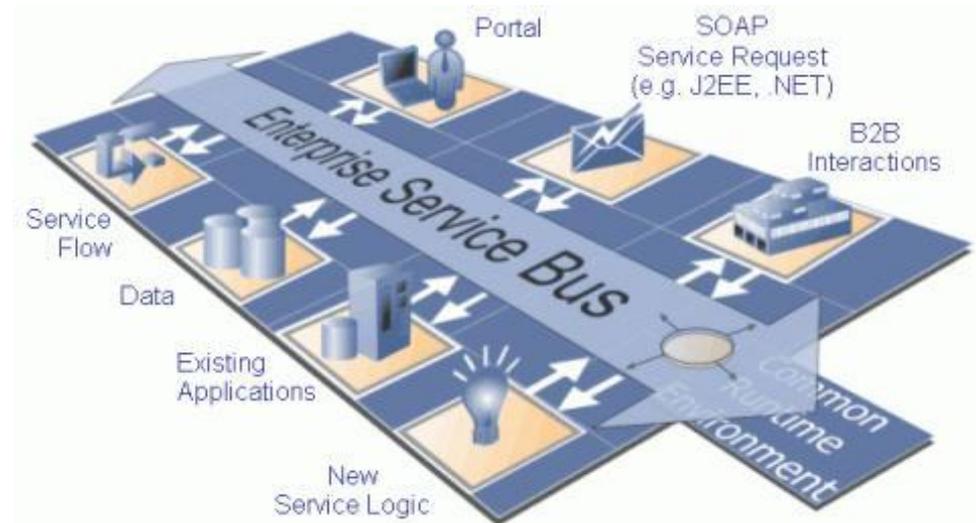


Common portal that can serve as single point for data exchange between CS and C2 and provide IA protection for each domain

- Enable CS operators/applications to obtain required C2 and off-board data via network connection instead of using “sneaker net”
- Expose existing CS data in a controlled manner to C2 users
- Automatically label data with ICISM tags
- Automatic virus scan and verify bulk data
- Verify data before installing within CS
- Better access control to external web sites
- Don't need to rely on ship's crew establishing and removing temporary connections for distance support

Data Exchanges

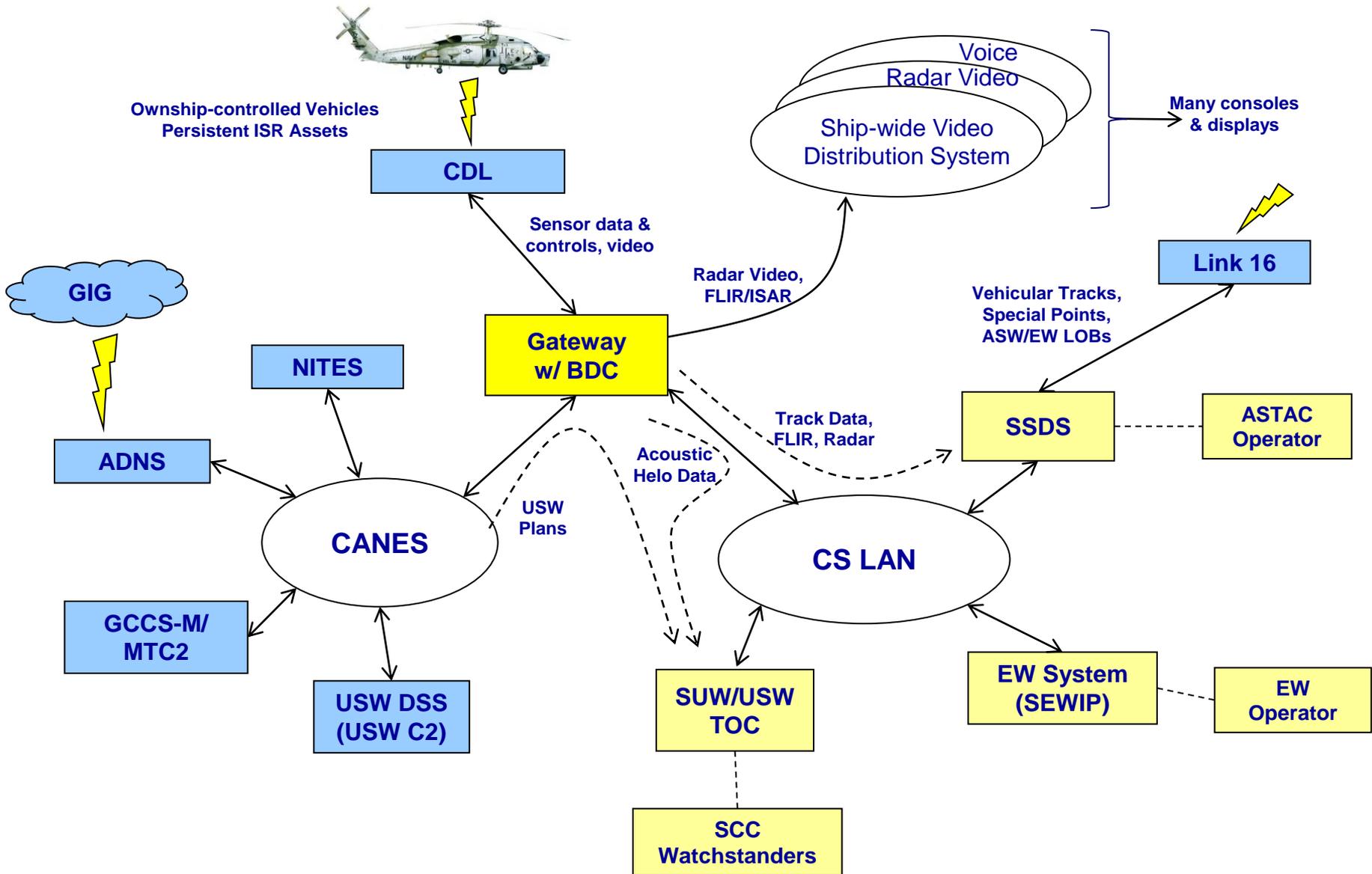
- GCCS-M / CV-TSC (Tracks and Overlays)
- CV-TSC / USW-DSS / JMPS (ASW & Planning Data)
- CV-TSC / SIPR (Chat, Web Browsing)
- SEWIP / GCCS-M (COP Virtual Terminal)
- SEWIP / SIPR (Parametric Library)
- SSDS / SIPR (BG Chat)
- BFTT / NCTE (Fleet Synthetic Training)
- CDL-S / CV-TSC (MH-60 Data)
- CV-TSC / NITES (Weather)
- SSDS / Video Displays (ASTAB Data)
- SSDS / GCCS-M (Track Data Manager) (Future)
- DBR / NITES (Weather) (Future)



Gateway Supports Speed to Fielding Objectives

- Combat system performance is stringently engineered and CS changes go through a rigorous test & cert process
- Gateway decouples CS and C2 applications to allow C2 applications to evolve rapidly without triggering a CS recertification
 - CS side of gateway will be engineered to expose useful CS data and to appropriately tag data to allow access by authorized users without impacting CS performance
 - C2 side of gateway will react to user-defined rule sets to transfer operationally relevant data to client applications
- CS will evolve more slowly through a series of Advanced Capability Builds to exploit additional data available from C4ISR systems via the gateway/BDC

MH-60R / Ship Integration Architecture for CVNs



S&T Challenges With Particular CS Relevance

- Improved coordination across operational and tactical mission planning activities, shared analytics, access to real-time readiness data
- Proactive ship stationing and sensor setup for potential adversary actions
- Environmental data to improve sensor laydown, search plans, and processing in adverse environmental conditions
- Improved ASW contact following from shared pre-contact data and analytics
- Improved situational awareness due to increased coverage from long-range sensors and persistent ISR assets
- Indications and Warnings to focus CS sensor assets on critical sectors
- Improved association of sensor data under ambiguous conditions
- Additional sensor attribute data to improve threat assessment, classification and identification
- Improved prediction of future target movement and corresponding system responses
- Ability to rapidly change response to new unexpected threat behavior in a deterministic and verifiable manner



**Program Executive Office
Command, Control, Communications,
Computers and Intelligence (PEO C4I)**

**Battlespace Awareness and Information Operations
Program Office (PMW 120)**

**Distributed Common Ground System – Navy (DCGS-N)
Increment 2 Overview for the ONR Data Focused Naval
Tactical Cloud Industry Day**

**24 June 2014
Jerry M. Almazan
Technical Director
(619)524-7889
jerry.almazan@navy.mil**

Statement A: Approved for public release; distribution is unlimited (20 JUNE 2014)

***Information Dominance
Anytime, Anywhere...***





Briefing Agenda

- DCGS-N Inc 2 Operational View
- DCGS-N PORs & Prototyping Efforts
 - Inc 1, Inc 2, & NITROS (Naval Integrated Tactical – Cloud Reference for Operational Superiority)
- Migration to Automated Workflows
- Program Structure
- DF NTC Research Opportunities for DCGS-N Inc 2
- Other Industry Collaboration Areas

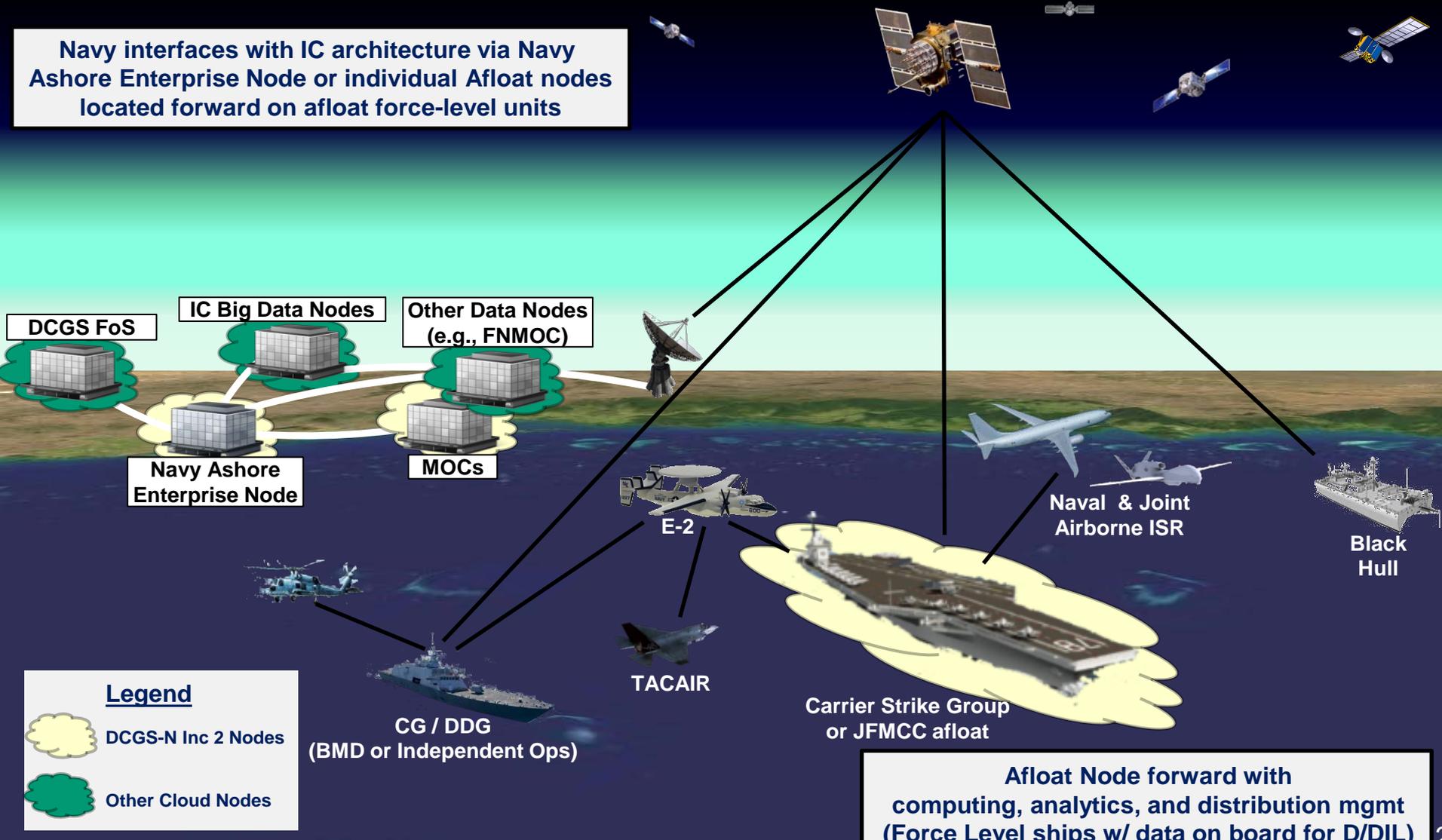


DCGS-N Increment 2 Operational View

- Pre-Baseline -



Navy interfaces with IC architecture via Navy Ashore Enterprise Node or individual Afloat nodes located forward on afloat force-level units





DCGS-N Increment 1 Where We've Been...

- Pre-Baseline-

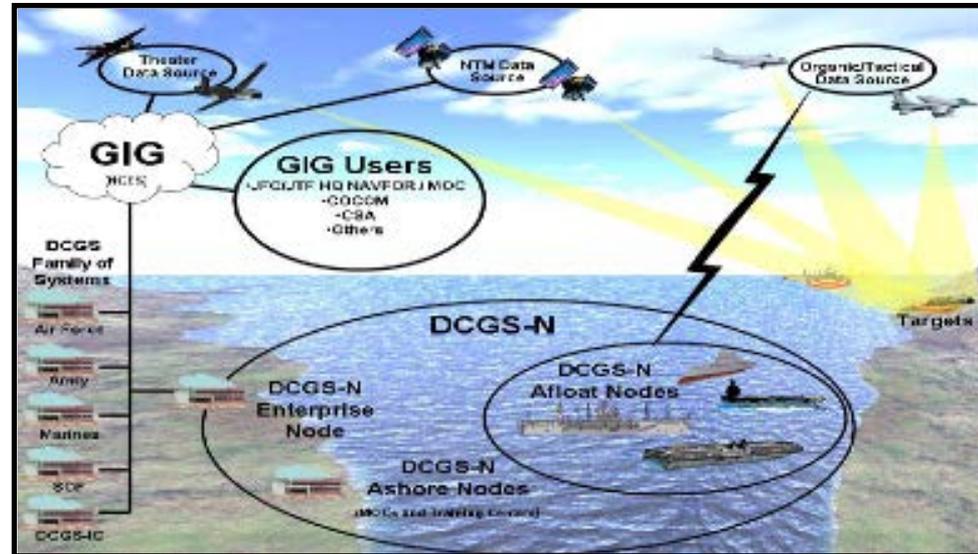


Inc 1 was about consolidating capability...

- Merged delivery of ISR&T tools *and* integrated priority SIGINT & IMINT capabilities
- Delivered an 80% solution / Milestone C in 2 years from program reset
- More than 29 Fleet Installations

... and taking the first steps towards a hosted environment

- Phased migration to CANES (Inc 1 Block 2)
- Get out of the hardware business and ultimately focus on the ISR&T support tools



3 racks, peripherals, and up to 30 workstations procured by DCGS-N

While Inc 1 continues to meet C/S/P, its lack of “bottom-up” design resulted ...

- Hard to use ...
- Challenging to train ...
- Difficult to maintain, and ...
- Simply not a satisfying experience for the sailor!

DCGS-N Inc 2 will fundamentally change this paradigm to resolve current readiness challenges and provide a system that is easier to operate, train, and maintain



DCGS-N Increment 2

Where We're Going... - Pre-Baseline-



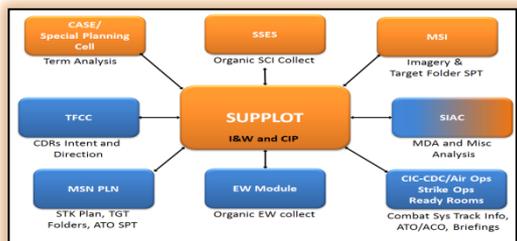
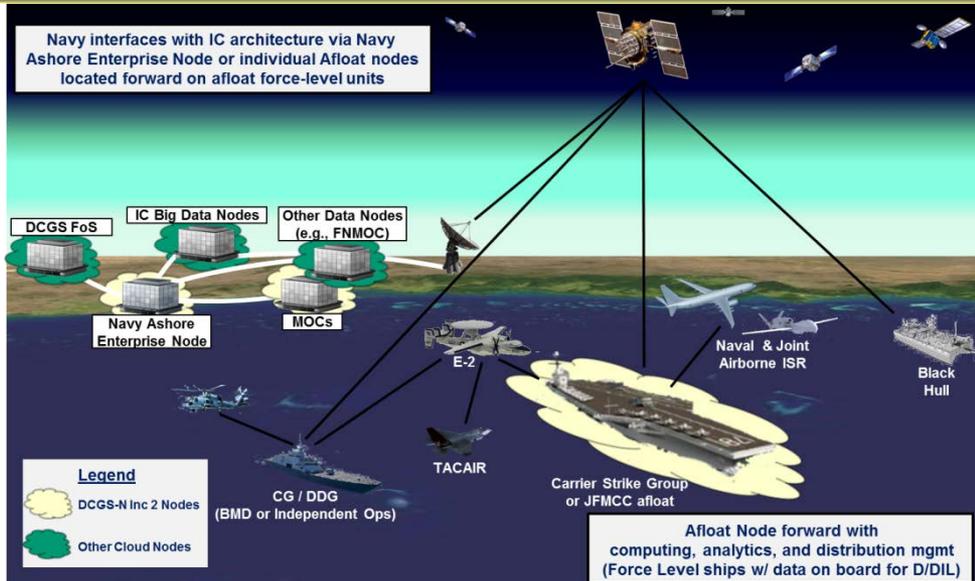
Inc 2



Inc 2 will rapidly field ISR&T support capabilities ...

- Annual Fleet Capability Releases that leverage COTS/GOTS tools/services
- Agile System Engineering incorporates Requirements Governance Board priorities and user feedback into development

... and complete the migration to a hosted environment ...



Automation and intuitive workflows

With the time to build on, fix and streamline Information Dominance Corps' tools ...

- Familiar tools and processes, refactored to the Cloud ...
- Intuitive workflow-centric design ...
- Anomaly detection, exploitation and automatic fusion ...
- ... to combat increased data loads brought on by the sensor "tipping point" and optimize sailor capabilities!

DCGS-N Inc 2 will simplify the sailors' experience and improve Fleet Readiness



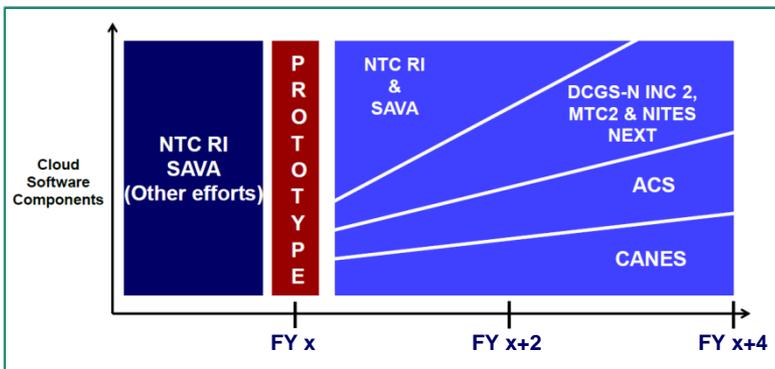
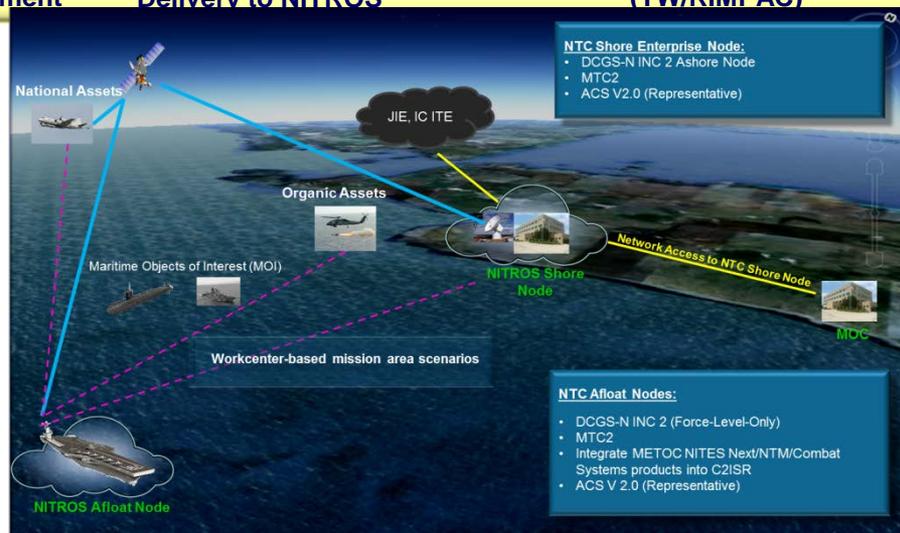
PEO C4I's NITROS Prototype

Helps Us Get There... - Pre-Baseline-



DCGS-N Inc 2's FCR-0 will deliver an early look at our capabilities to NITROS ...

- 4 IDC KPPs
 - Automatic Fusion
 - Automated Exploitation & Detection
 - Visualization
 - Collection Management & Awareness
- Core legacy apps co-existing with large-data store
 - GALE (SIGINT), SO CET (IMINT / Targeting), CMMA (Collection Management)



... PEO C4I's NITROS Prototype directly impacts more than just DCGS-N Inc 2 ... other PORs and projects too!

... and wring out our agile processes ...

- Requirements
 - Contracting
 - Integration & Development
 - Cyber Security
 - T&E
 - Fielding
- ... via continuous involvement with our Fleet, POR, and S&T partners!

FCR-0/NITROS will provide lessons learned to DCGS-N Inc 2, other PORs and projects, and Fleet IDC Partners in prep for Inc 2 FCR-1 and beyond



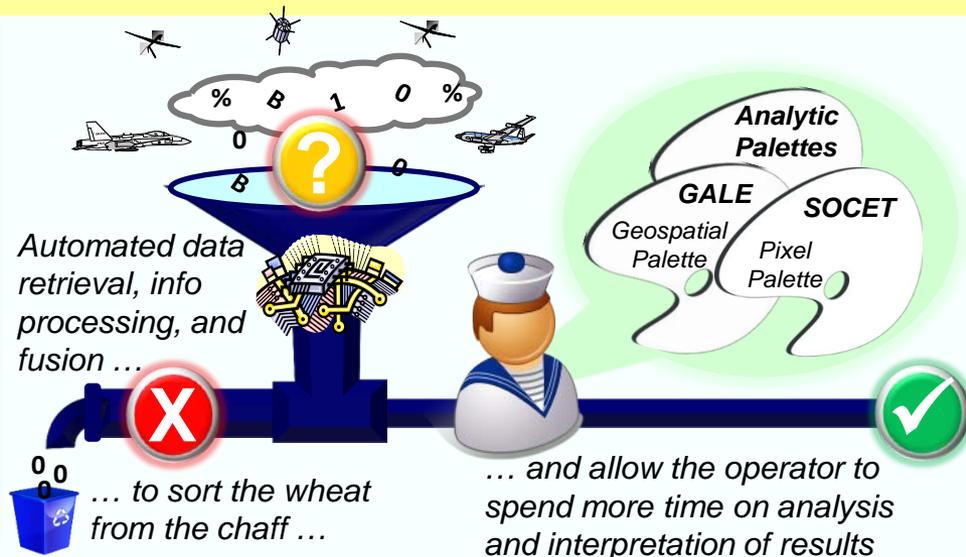
Complementary Role of Legacy Apps in a Workflow World



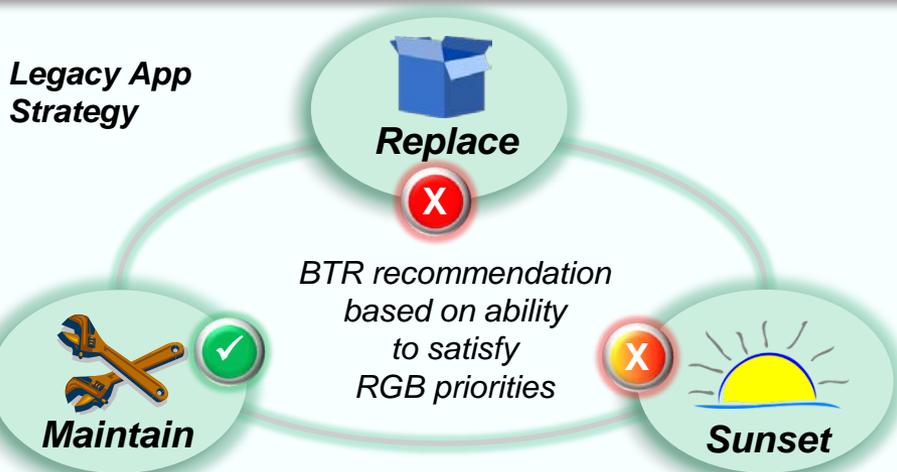
It's hard to ask the questions today, that we need to answer tomorrow ...

Intuitive workflows & automated fusion are based on anticipating questions and ...

- Generating an encyclopedic grasp of the environment ...
- Reducing the need for situational awareness (SA) maintenance ...
- Optimizing the analysts' time, to focus on anomalies, issues, and uncertainties



Legacy App Strategy

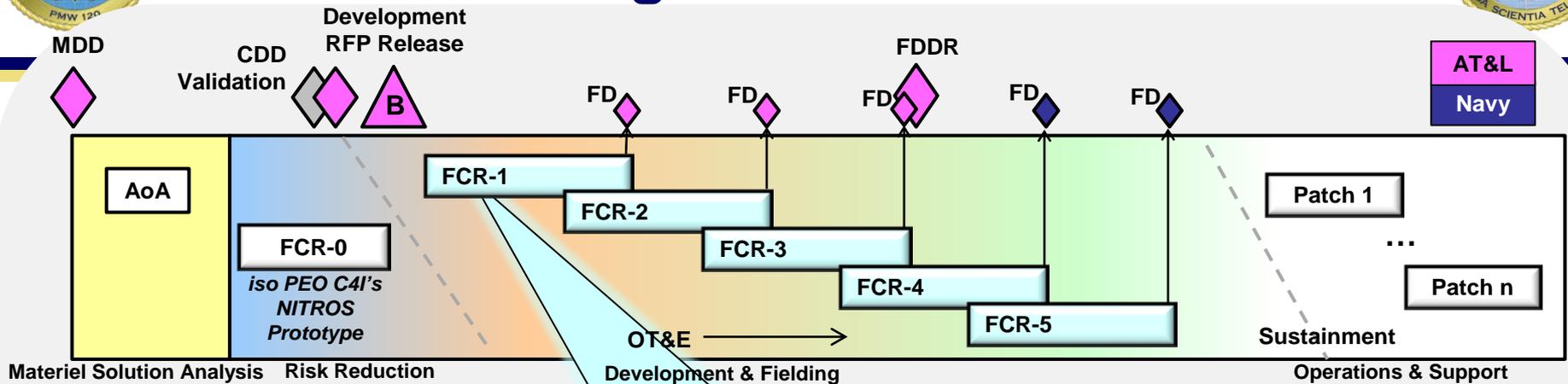


... while relevant legacy apps (i.e., outside the automated workflow) help answer the unanticipated question ...

- Providing forensic, recursive analysis ...
- Answering new questions about old data ...
- Ensuring survivable decision support that avoids the historian's fallacy

Together, DCGS-N Inc 2 will provide the tools and time to answer tomorrow's questions – supporting timely, accurate SA and enhanced speed to decision

DCGS-N Inc 2 Program Structure - Pre-Baseline-



- AoA Analysis of Alternatives
- BD Build Decision
- BTR Build Technical Review
- FCR Fleet Capability Release
- FD Fielding Decision
- FDDR Full Deployment Decision Review
- FTR Fielding Technical Review
- IT Integrated Test
- KPP Key Performance Parameter
- MDD Materiel Development Decision
- OT&E Operational Test & Evaluation
- RFP Request for Proposal
- RGB Requirements Governance Board



Illustrates the program structure and sequence of decision events only; not intended to reflect time

Preliminary FCR Objectives – subject to trade-off analysis/feasibility assessment and RGB approval

FCR-1	FCR-2	FCR-3	FCR-4	FCR-5
<ul style="list-style-type: none"> ▪ Refactor DCGS-N Inc 1 to the cloud ▪ SIGINT/Tracks Workflows ▪ KPP initial minimums 	<ul style="list-style-type: none"> ▪ GEOINT Workflow updates and targeting support ▪ FCR-1 backlog/deferred requirements 	<ul style="list-style-type: none"> ▪ Current readiness updates ▪ FCR-2 backlog/deferred requirements 	<ul style="list-style-type: none"> ▪ Current readiness updates ▪ FCR-3 backlog/deferred requirements 	<ul style="list-style-type: none"> ▪ Current readiness updates ▪ FCR-4 backlog/deferred requirements

IT Box supports Evolutionary Acquisition and Agile Development based on rapidly changing Fleet priorities. Each FCR builds on the prior FCR.



DF NTC Research Opportunities for DCGS-N Inc 2



(not limited to the examples below)

- Anti-Submarine Warfare (ASW) Area
 - Enemy Course of Action Data
 - Use of Historical Pattern of Life Data
 - Organic/Non-Organic Environmental Data to Support Mission Planning (including optimal sensor deployment) and Dynamic Execution
 - Monitor differences between expected & actual conditions
 - National Technical Means



DF NTC Research Opportunities for DCGS-N Inc 2 (cont'd)

(not limited to the examples below)



- Integrated Air/Missile Defense (IAMD) Area
 - Improved Identity Classification, Intent & Future Movement Prediction, & Association
 - Fuse Organic & Non-Organic, Multi-INT to ID Maritime Objects of Interest (MOI's)
 - Predict Intent & Future Movement
 - Association with other MOI's
 - Threat Evaluation and Weapon Assignment (TEWA)
 - Improved Situational Awareness
 - ID Adversary Capabilities, Behaviors, & Operational Patterns
 - Improved Planning of Asset Movement and Optimized Weapon Usage
 - Battle Damage Assessment (BDA)
 - Multi-INT/Multi-Source (including Cyber)
 - Improved Spectrum Operations
 - Cyber Awareness



Other Industry Collaboration Areas

Where We Need Your Help



- **CLOUD Challenges**
 - CLOUD sync in challenged bandwidth environments
 - CLOUD related "dashboards" that provide system status (HW & SW) and self healing/help
- **Data Science & Management**
 - Identify Data Sources, Define the Metadata and Objects, Develop Ingestion, & Indexing strategies in support of Alerting & Multi-Int Fusion
 - Move disparate data from multiple sources and security domains into a common maritime-defined schema (Subject, Predicate, and Object) in real-time
 - Development of non-proprietary interoperable technology standards. Example standards for virtualization technology.
- **Automated Correlation & Fusion to Maritime Objects**
 - Correlate & Fuse to the correct vessel
- **Full Motion Video (FMV) Automated Object Recognition (AOR) in a Maritime Environment**
 - Automatically detect & recognize Maritime Objects of Interest (MOIs) from FMV
 - Extract Geospatial Intelligence from sensor metadata
- **Fusion-Based Anomaly Detection**
 - Correctly detect anomalous behavior of objects that deviates from normal historical patterns
 - Heuristic/Rule-based analytics & machine-learning algorithms using all-source data to be considered
- **Automated Deceptive or Non-emitting Vessel Tracking**
 - Automatically recognize and track vessels that are not broadcasting correct AIS data
- **Automated Alerting**
 - Automatically alert correctly on user-defined Vessel of Interest criteria



**We Deliver
C4I Capabilities
to the
Warfighter**

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**Program Executive Office
Command, Control, Communications,
Computers and Intelligence (PEO C4I)**

MTC2 Industry Day Brief

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***Information Dominance
Anytime, Anywhere...***





Agenda



- BLUF
- Development Strategy and Schedule
- Requirements Development
- Integration with Naval Integrated Tactical-Cloud Reference for Operational Superiority (NITROS)/NTC-RI
- C2 S&T Challenges



BLUF



- Current Focus
 - Requirement maturation
 - Evaluation of materiel solutions against those requirements
- MTC2 Design Concept
 - Provide core functions while in an austere data environment
 - Provide enhanced functionality in a rich data environment
 - Per OPNAV, leverage the rich data that cloud-enabled environments may provide
- MTC2 Capabilities
 - Move beyond current C2 designs (historically focused on only SA)
 - Leverage additional data from a spectrum of resources when available



MTC2 Development Strategy

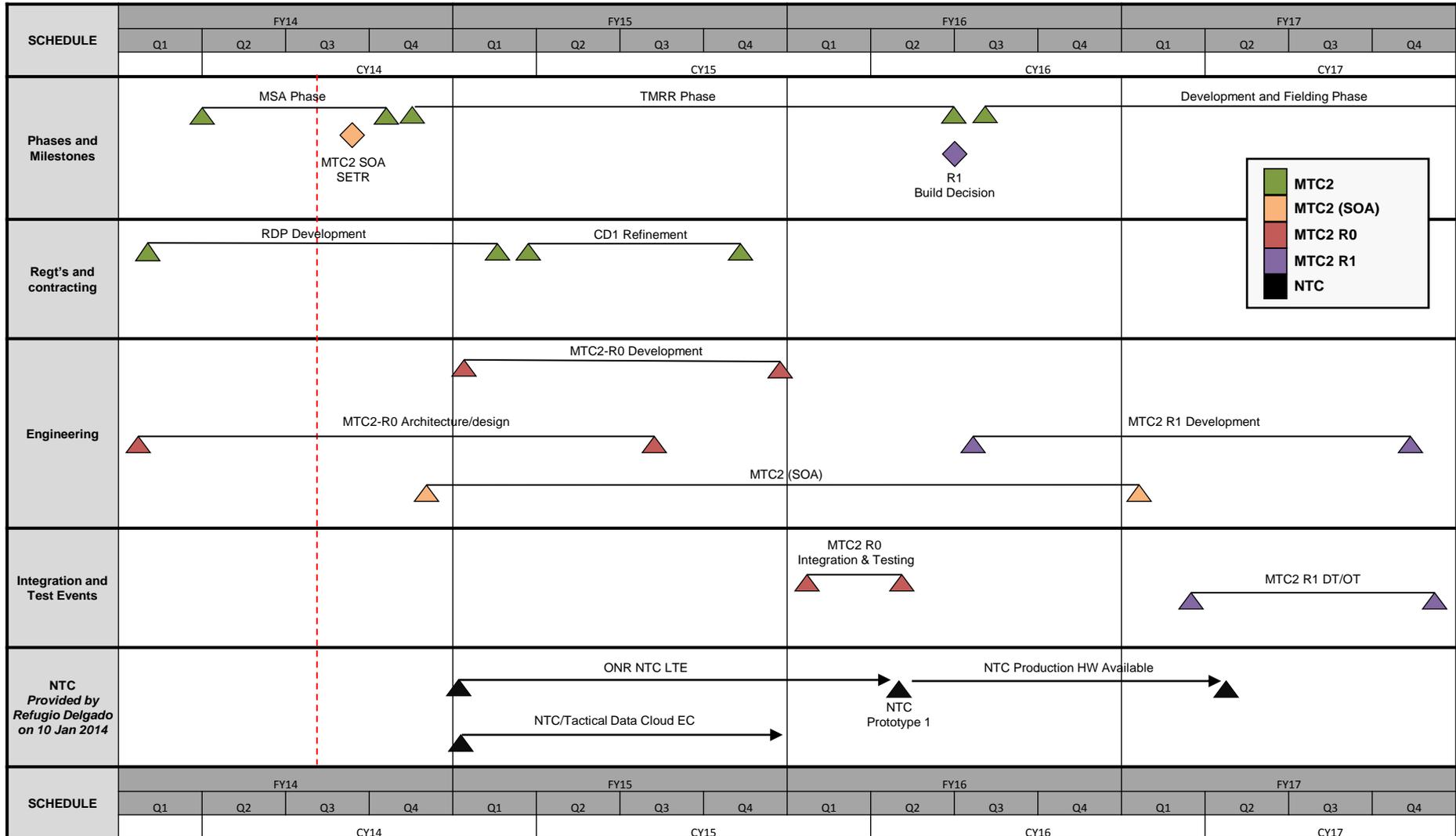


There will be 4 main efforts for MTC2

MTC2 Variant	Fielding Sites	Fielding Date	Notes
MTC2 (SOA)	2 sites running C2RPC UCB II	4QFY14	Updated & Accredited version of C2RPC UCB II
MTC2 R0	2 Sites (1 afloat and 1 ashore)	Operational Prototype – 2QFY16	Prototype fielding to support requirements validation and R1 activities
MTC2 R1	All sites (afloat and ashore)	Initial Fielding – 1QFY18	GCCS-M Replacement. Initial PoR fielding
MTC2 R2 (TBD)	All sites (afloat and ashore)	Initial Fielding – 1QFY19	MTC2 leveraging enhanced data services and availability



MTC2 Schedule Alignment with NTC





MTC2 R1/R2 Capability Areas and Echelons



C2 Capability Areas

C2 Echelons	CA-1	CA-2	CA-3	CA-4	CA-5	CA-6	CA-7	CA-8	CA-9
	Command Leadership	Organization & Command Relationships	Situational Awareness	CDR's Intent & Guidance	Collaborative Planning	Synchronize Execution	Monitor & Assess	Leverage Mission Partners	Core Enabling Capabilities
OPNAV/USFF/ NCF/CPF									
MOC/CTF									
CSG/ESG/ARG									
SAG									
Unit (Various)									

MTC2 Requirements

- ROE, Op Risk Mgmt, Authorities
- Mission Readiness Assessment
- Task Organization, Org Charts, Command Relationships
- Enhanced COP, Info Drill-Down, Environmental, Dashboards, Collaboration
- Mission Analysis, Orders, CDR's Intent & Guidance
- COA Development/Analysis, CCIRs, Tasking, Orders, Sync Matrix
- Deployment/Employment Scheduling, Replanning, Decision Points
- Mission Partner Collaboration, RFS, RFS, & Info Sharing
- Workflows, Alerts, Viz Preferences, D-DIL, Security, Info Mgmt



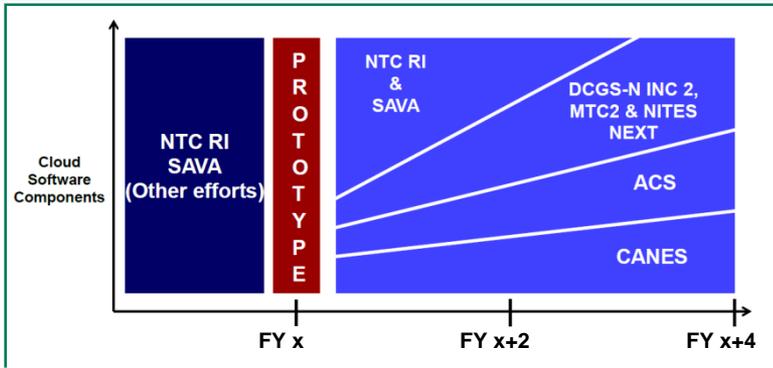
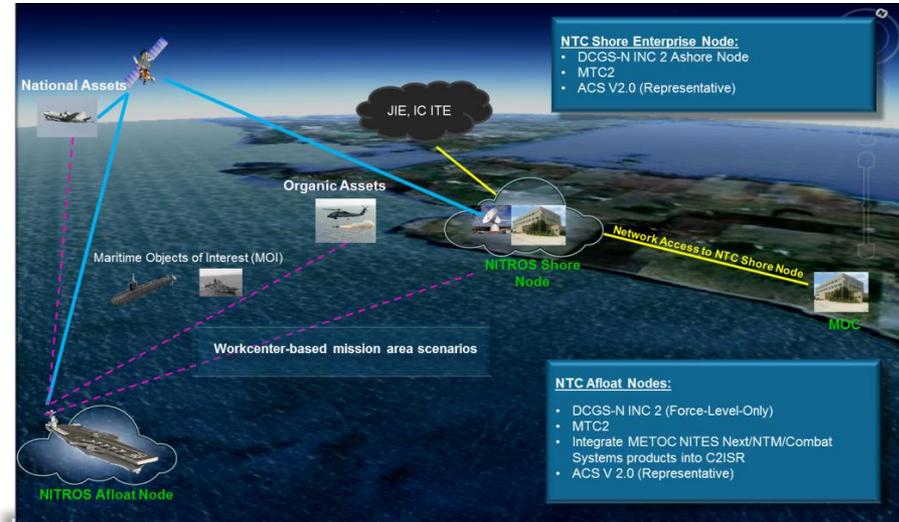
PEO C4I NITROS Prototype

Helps Us Get There... - Pre-Baseline-



MTC2 R0 will deliver an early look at our capabilities to NITROS ...

- Track and Overlay Management
- CCIR/PIR
- Common Map API
- Focus on deploy-ability, supportability, maintainability and scale-ability
- Consolidated Data Store
- Establish Normalized Data Layer
- Reduce IA vulnerabilities



... and wring out our agile processes ...

- Requirements
- Contracting
- Integration & Development
- Cyber Security
- T&E
- Fielding

... via continuous involvement with our Fleet, POR, and S&T partners!

... PEO C4I NITROS Prototype directly impacts more than just MTC2... other PORs and projects too!

NITROS will provide lessons learned to MTC2, other PORs and projects in preparation for MTC2 R1 and beyond



S&T C2 Challenges



- Provide the Commander with timely, continuous and automated IAMD and ASW:
 - Overall Mission Assessment
 - Course Of Actions (COAs) recommendations
 - “What If” warfighter options



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