ENVIRONMENTAL DATA CUBE SUPPORT SYSTEM

The Environmental Data Cube Support System (EDCSS) helps reduce barriers to using realistic environment representation in DoD Modeling and Simulation (M&S). In the past, simulations often used rudimentary statically declared environmental data and effects, which represented unrealistically benign conditions. While many of these simulations (and others) are employed today, there is an increasing desire to couple simulations together in federations (between platforms) and improve realism through physics-based performance models. To do so requires the use of consistent and realistic environmental data and effects. The EDCSS provides a response to this demand, offering access to authoritative source data for all four environmental domains (Atmosphere, Ocean, Terrain, and Space) in a flexible manner that allows for disparate simulation applications to consume a single environment representation via their own custom formats and/or protocols.

The EDCSS is not itself an environmental database or model; rather it leverages source data and modeling capabilities from authoritative DoD, NOAA, and other sources. The primary emphasis for EDCSS is to use relevant historical scenarios as the basis of its environment representation, however EDCSS technology can be employed to process live forecast data and products as well. The EDCSS, depicted in Figure 1 below, offers the ability to query, browse, and access source databases for reuse, but also provides a project-centric user work flow that promotes the declaration of specific product and environment scenario requirements to which the EDCSS can recommend the most appropriate resource to be used. In this way, consumers remain focused on their own requirements and not the mercurial landscape of source data and modeling capabilities.
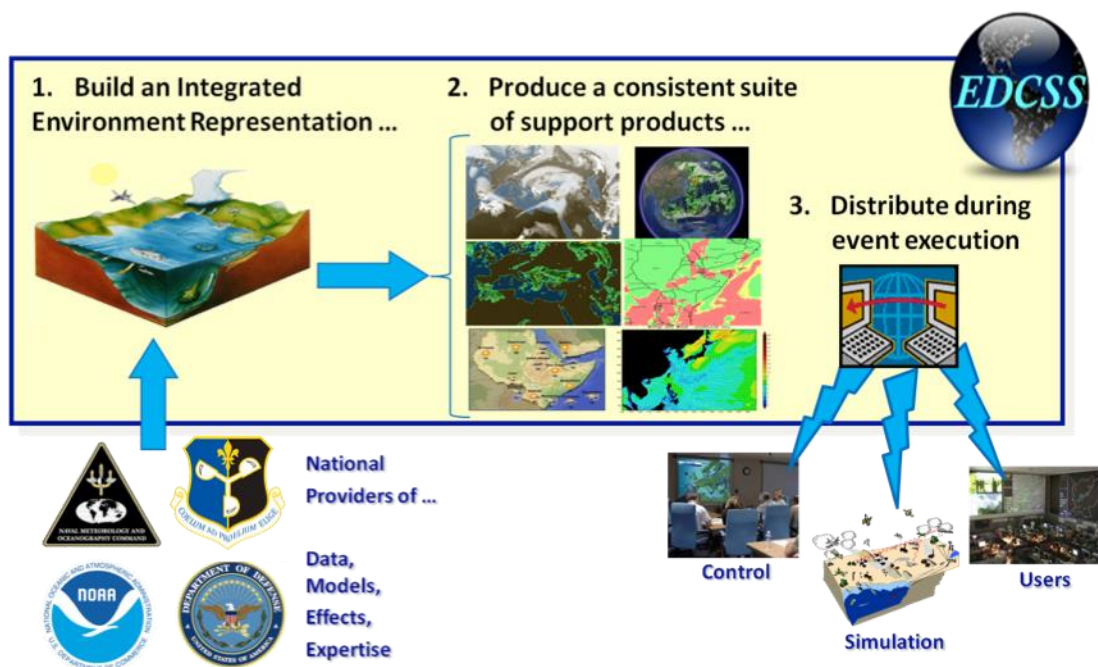

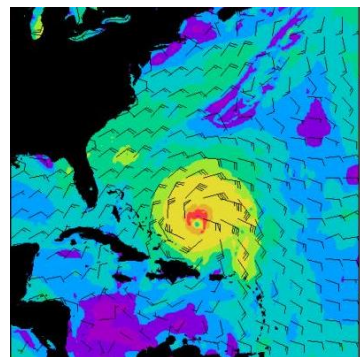**Figure 1: EDCSS Conceptual Architecture**

The EDCSS produces custom configured products in the form of Data, Effects/Impacts, Text, and Graphics. Data products include both standards-based formats and customer application-specific formats. Effects products capture the influence of the environment on specific military systems (e.g. sensors, vehicle performance, inter-visibility) and are provided in a novel multi-dimensional lookup table format referred to as a Hypercube. The EDCSS also provides rule-based System Impact products that capture the nominal response of military systems to the underlying environment scenario. The EDCSS Text products enable stimulation of operational Command and Control (C2) applications. The EDCSS Graphic products provide customized views of the environment scenario and can range from simple graphics to simulated satellite imagery and radar products.

In addition to coordinating production of a consistent suite of end-user environment representation products, the EDCSS also offers technology for the distribution and integration of those products. The EDCSS Distributor is a lightweight web application that can be readily deployed on simulation networks to provide a single access and control point for all environment representation products a user community requires. The Distributor offers both a web interface for human interaction and web services for automated download from consuming applications. To facilitate efficient ingest of data and effects products into simulation applications, and to minimize duplication of effort across the community, the EDCSS provides a Runtime Integration Module (RIM) that exposes straightforward Java and C/C++ language APIs for direct access to data and effects.

The EDCSS has been under development by Atmospheric and Environmental Research (AER) since 2007, and all EDCSS software is delivered to the government as open source and requires no commercial or proprietary software or hardware to operate. Today the EDCSS is a mature technology routinely employed for Combatant Commander (COCOM) Joint Training Exercises, Air Force Combat Air Forces Distributed Mission Operations (CAF DMOs), Navy Fleet Synthetic Training (FST), and the OSD Planning and Analysis communities. Both the Air Force and Navy have committed to operationalizing the EDCSS technology, with efforts underway at the 557th Weather Wing and the Navy Warfare Development Command (NWDC).
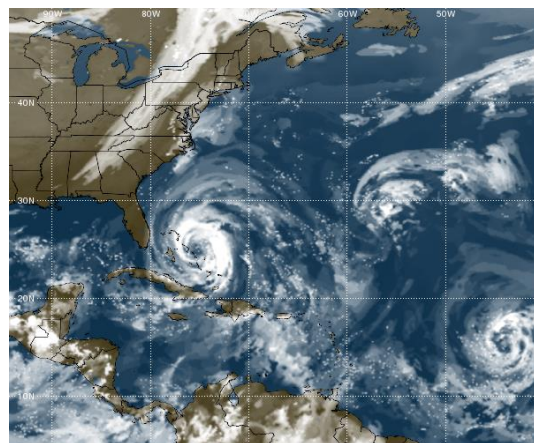
AER is now also endeavoring to offer EDCSS technology applied to NOAA Big Data and other environmental data resources available on the Amazon Web Services (AWS) platform. The EDCSS service oriented architecture (SOA) offers a rapidly adaptable infrastructure to process a wide range of data sets into unique product offerings for customers. Those value added product streams as well as component EDCSS services are available for purchase and integration into customer systems.

Full information and documentation about EDCSS are provided at https://www.aer.com/government/modeling-and-simulation/.

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