Oceanids command and control (C2) data system – Marine autonomous systems data for vehicle piloting, scientific data users, operational data assimilation

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Abstract

This paper describes the development of the data system that is a component of the Oceanids command and control (C2) system. Oceanids C2 will be an integrated platform that will combine piloting, data processing, data analytics, and data delivery for the fleet of autonomous platforms hosted by the UK National Oceanographic Centre.

The data system is built using standard ontologies for structure and the NERC vocabulary server for terms to maximise metadata interchangeability. Data delivery will include dissemination to the Ocean Glider Network (for inclusion in Copernicus and EMODNet) in addition to the projects deploying autonomous vehicles.

Introduction

The National Oceanography Centre (NOC) operate a fleet of approximately 36 autonomous marine platforms including submarine gliders, autonomous underwater vehicles, and autonomous surface vehicles. Each platform effectivity has the capability to observe the ocean and collect data akin to a small research vessel. This is creating a growth in data volumes and complexity while the amount of resource available to manage data remains static. The OceanIds Command and Control (C2) project aims to solve these issues by fully automating the data archival, processing and dissemination. This is as part of a combined planning, piloting data processing, visulisation and delivery platform as described in figure 1.

C2 data system

The data architecture being implemented jointly by NOC and the Scottish Association for Marine Science (SAMS) includes a single Application Programming Interface (API) gateway to handle authentication, forwarding and delivery of both metadata and data. Technicians and principle investigators will enter expedition data prior to deployment of vehicles enabling automated data processing when vehicles are deployed. The system will support automated metadata acquisition from platforms as this technology moves towards operational implementation.

The metadata exposure to the web builds on a prototype developed by the European Commission supported SenseOCEAN project and is via open standards including World Wide Web Consortium (W3C) RDF/XML and the use of the Semantic Sensor Network ontology and Open Geospatial Consortium (OGC) SensorML standard. Metadata exposure via SSN and SensorML is achieved using a database build using prexesting ontologies and terms from the the NERC vocabulary server 2.0 (NVS2) as showing in figure 2. Data will be delivered in the marine domain Everyone's Glider Observatory

(EGO) format and OGC Observations and Measurements. Additional formats will be served by implementation of endpoints such as the NOAA ERDDAP tool.
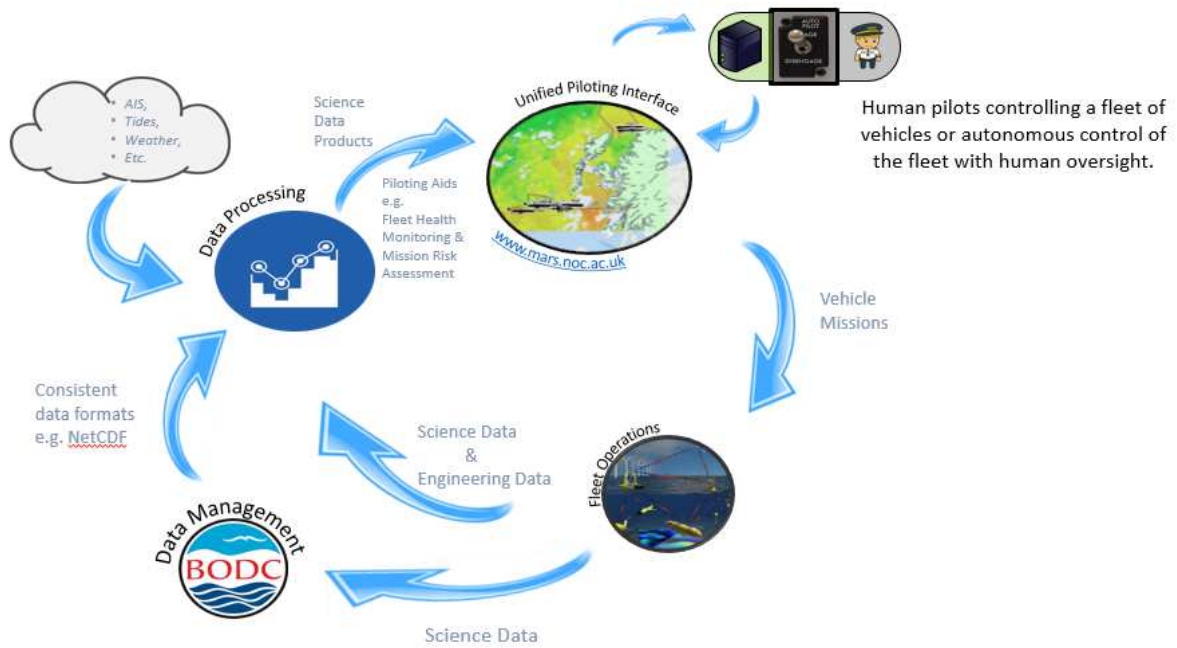

Figure 1: flow chart showing the integrated Oceanids command and control system.
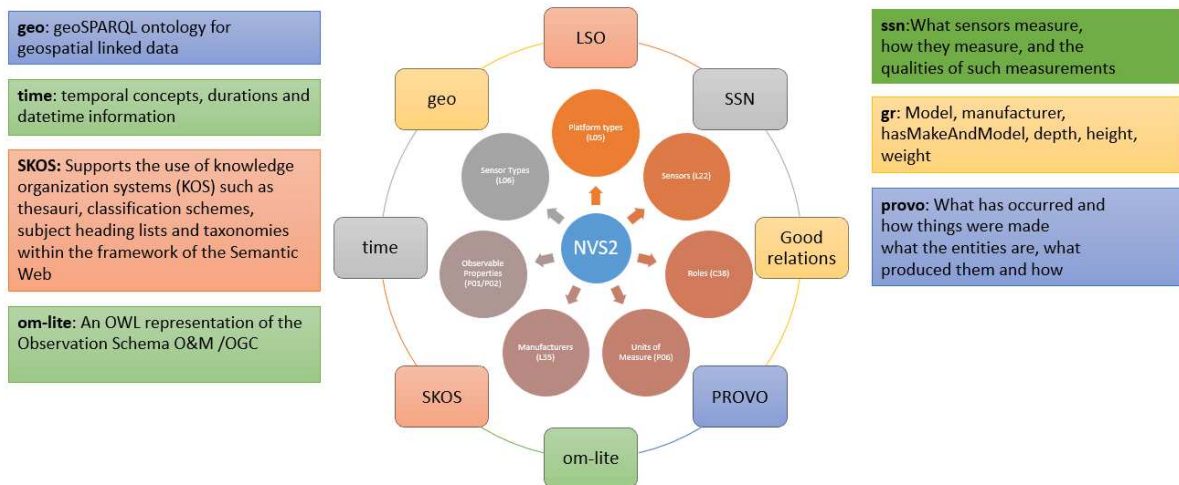

Figure 2: The fusion of ontologies and vocabularies from the NERC vocabulary server that enable the delivery of standardised metadata in both W3C SSN and OGC SensorML standards.

Data delivery

This standardised data delivery via the API gateway enables timely near-real-time data to be served to Oceanids users, BODC users, operational users and big data systems. The use of open standards will also enable web interfaces to be rapidly built on the API gateway and delivery to European research infrastructures that include aligned reference models for data infrastructure. It is intended for the C2 data system to contribute data and metadata directly to the Ocean Glider network which enabling the data to be included in Copernicus and EMODNet data products.