Autonomous seafloor mapping
Kongsberg on the winning team of XPRIZE

Mr. Terje Haga Pedersen
Kongsberg Maritime
Mapping, Positioning and Communication, MPC
Horten, Norway
Terje.haga.pedersen@km.kongsberg.com

Mr. Richard Mills
Kongsberg Maritime
Marine Robotics, MaRo
Horten, Norway
Richard.Mills@km.kongsberg.com

Abstract—This paper is about how technologies using Remote Survey Operation, Cloud-solution, autonomous surface and underwater vehicles come together to achieve safer, cheaper and more environmentally friendly survey operations.

I. XPRIZE
Following the announcement of the Ocean Discovery XPRIZE, GEBCO proposed a solution to win the competition supported by the Nippon Foundation. The concept was built around data acquisition using a combined system of one surface vessel accompanied by an underwater autonomous vehicle, the KONGSBERG HUGIN AUV System.

KONGSBERG supplied support to the GEBCO-NF Alumni Team by providing the K-MATE autonomous control system for their unmanned surface vehicle, SEAKIT Int.’s USV Maxlimer, hydroacoustic sensors EM304 and HiPAP 502. The HUGIN AUV System was equipped with the KONGSBERG HISAS 1032 configured for extra wide area coverage, combined with an EM2040 MBES as a gap filler.

In November 2018, the team fulfilled the requirements for the competition during a 36 hour mission, where 24 hours was mapping only.

During the 24 hour period that was given to map the given area, GEBCO-NF mapped 278 square kilometers to a resolution of 5 by 5m down to 4000m water depth.

The data set was a combination of EM304 data, HISAS 1032 in wide area bathymetry mode and the EM2040 system onboard the AUV. Throughout the mission, position updates were given to the AUV through the USV-mounted HiPAP 502 system. The entire mission was controlled through the onboard VSAT satellite connection to the USV that enabled remote supervision of the data acquisition and AUV control.

II. MAPPING CLOUD
Mapping Cloud, built on the KONGSBERG Kognifai Digital Platform, provides all players with a truly open cloud environment where data can be uploaded, stored, processed, shared and distributed in real time and as finished products. Mapping Cloud is used as the platform to provide services to both realtime Remote Operation and post-processing analysis. Distributing data to other systems makes it easy to use the best of the best processing tools available from anyone.

III. REMOTE OPERATIONS
Remote operation using Mapping Cloud demonstrates how survey vessels like the Kongsberg USV Sounder can be used to deliver realtime data that can be used for monitoring progress and quality control. One operator can control several vessels from anywhere on the Internet, even control the parameters of the multibeam echosounder in the ongoing survey.