VALKYRIE: FIELD CAMPAIGN RESULTS AND AUTONOMOUS SAMPLING FOR A LASER-POWERED CRYOBOT. E.B.Clark[1], W.C.Stone[1], B.P.Hogan[1], V.Siegel[1], K. Richmond[1], S.Lelievre[1], C.Flesher[1], J. Harman[1], N.Bramall[2], [1]Stone Aerospace, Del Valle, TX; [2]Leiden Measurement Technololgy, San Carlos, CA.

Introduction: VALKYRIE (Very deep Autonomous Laser-powered Kilowatt-class Yoyoing Robotic Ice Explorer) is a prototype cryobot (ice-penetrating robot) developed by Stone Aerospace as part of the NASA ASTEP program to demonstrate technology for descending through the icy crusts of worlds such as Europa or Enceladus. VALKYRIE project is a field-deployable autonomous ice-penetrating cryobot of sufficient scale to deploy realistic astrobiology science payloads through ice caps of substantial thickness and to enable recovery of the vehicle and its in-situ-acquired samples at the conclusion of a mission. The project tested novel life-sensing instruments and automated sampling systems and algorithms in the context of field deployment of the vehicle through glacial ice. The VALKYRIE project developed novel technologies that enable multi-kilometer-thick ice cap penetration including: a high power fiber laser sending power through a vehicle-deployed optical wave guide; integrated onboard thermal management systems; and optional active water jetting to increase descent speed or turn in the ice. VALKYRIE was deployed to the Matanuska glacier in Alaska during the summer 2014 and 2015 field seasons and conducted a series of missions that penetrated into the glacier to demonstrate novel cryobot technology and gather scientific data during descent analogous to what might be collected during a penetration mission to an icy world.

VALKYRIE is equipped with an onboard suite of scientific instruments for studying the meltwater generated by the robot as it descends through the ice. It has the capability to spectrographically identify proteins and minerals of interest present in the ice continuously in real time and incorporates autonomous decision-to-collect algorithms to divert meltwater samples for more detailed but costly analysis.