Tunguska Event and magnetic signature over the epicenter. M. Takac[1], G. Kletetschka[1,2,3], R. Kavkova[1] ,V. Petrucha[4], M. Dressler[4], [1] Faculty of Science, Charles University, Czech Republic, [2]Institute of Geology, Academy of Sciences of the Czech Republic, Czech Republic, [3]Department of Geology and Geophysics, University of Alaska Fairbanks, USA, [4]Czech Technical University in Prague, Faculty of Electrical Engineering, (takacmarian@natur.cuni.cz).

Introduction: Famous but yet unexplained phenomena happened on 30. June 1908 in Siberia, Russia. A large forested area was affected by this explosion. The direction of the impactor and its kinetic energy estimates tried to provide clues about the nature of the impactor [2,3]. The tree-fall pattern has indicated that the asteroid moved on 5–45° inclined trajectory from an azimuthal direction of 99–127° [4]. By chance, the epicenter of the airburst was just offset from the ancient 250 million years old crater center of a lower Triassic Kulikovsky paleo-volcanic complex that forms part of the Siberian igneous province [4].

But no impact crater or meteorite residual was found yet. People who lived near affected area described long-lasting thunder and long-lasting bright glow from the direction of the epicenter of the event [5]. Many scientific expeditions were done to the epicenter during the last decades. Location if the Tunguska event is remote. Deep in Siberia, where are dense forests, large swamps, extreme temperatures, and wild animals. This environment along with its remoteness makes any geophysical measurements and fieldwork extremely though. Any ground survey is very slow and difficult. Since no significant impact structure was found yet we decided to do geophysical measurements and map the epicenter of the Event.

Methods: Our objective was to create a detailed magnetometer map of the epicenter. Satellite-based magnetometer data are available worldwide. A detailed magnetometer survey hasn't been done yet in this area. Magnetic anomalies in epicenter and deviations from anomalies driven by geology could reveal the mechanism or cause of the explosion in Tunguska. Due to rough terrain and large swamps the conventional method of magnetometer survey is nearly impossible at this site. We decided to carry out airborne magnetometer survey of the Tunguska Event epicenter. Our survey is UAV based magnetometer survey so we were able to measure a large number of points in a relatively short time period and regardless of the terrain difficulty. We programmed drones to fly profiles autonomously in the north to south loop pattern. This way we measured area 8.5km x 4km with 100m line spacing. We were flying fixed altitude at 110m above our home point. The vertical speed was 13m/s. Magnetometer data were collected automatically at 62.5samples/s. UAV with magnetometer collects X,Y,Z components of the magnetic vector. Position, altitude and sensor temperature is recorded along with magnetic data. Using UAVs (drones) we were able to collect a significant amount of data. Total magnetic intensity is later computed from the data and corrected with altitude data and with temperature data eventually. We plotted the data (more than 5 millions of datapoints) to map of magnetic anomalies. Most of the anomalies which we recorded over the epicenter correspond with the known geological situation of the area.

Material and Instruments: We used two unique magnetometers that have total weight less than 350g each, including battery and GPS datalogger. One magnetometer was attached to the UAV (unmanned aerial vehicle-drone) and the second, identical magnetometer, was used as a base station. Both magnetometers are three-axis vector fluxgate magnetometers with flat-ring cores and were built to be used primarily for UAV based magnetometer survey. A similar device would be used on Mars. Magnetometer data were collected with two parallel magnetometers where one served as a ground station and one was part of the autonomous drone. We used four light and portable UAV's and systematically switched magnetometer between them so continuous measurement workflow was possible. Due to the remote location of the site was important to solve the charging needs of the instruments and drones. A portable petrol AC generator was used and moved along the site to provide continuous availability of electric power to charge drones and magnetometers.

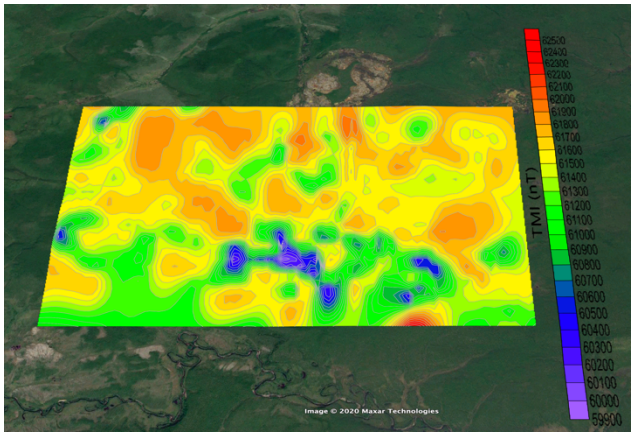

Fig. 1, Magnetic anomalies(nT) over the Tunguska Event epicenter. Most of the magnetic anomalies correspond to the geological structure of the area.

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