Eastern Antarctica with its surrounded sea ice is exposed to the vast southern ocean on the northern side  
which extends into the equatorial region of Indian Ocean. The Antarctic Ice area changes are seasonal  
due to freezing in winter and melting in summer because of the extension of the sea ice to open ocean  
environment heat flux variations. The available data shows that the sea ice cover in Antarctica varies  
between winter to summer with a maximum of about 19 million km 2 and to a minimum of just 3 million  
km 2 respectively. Apart from seasonal fluctuations, strong westerly winds along with high waves and  
frequent storms are the prime factors which shape up the sea ice cover in Antarctic regions.  
The thickness of the Antarctic sea ice is getting restricted in thickness due to high surface heat flux and  
heat supplied from the warm circumpolar deep water currents. Even though the extent and variability of  
the Antarctic sea ice coverage has been studied over the decadal time period through satellite  
oceanography, a reliable estimate on thickness of ice is lacking to understand the variability of the climate  
forcing mechanism and its impact. To understand further, it is important to know about pole ward  
westerly winds, tropospheric ozone depletion, mechanisms like Ekman transport, upwelling etc to  
establish the coupling of atmosphere, ocean and polar ecosystem. Apart from ice shelf observations,  
shallow lakes in the Antarctic continent are least explored to understand the algal mats characteristics at  
the lake beds to understand the biotic environment in the extreme climates.  
In order to quantify such phenomena, it is imperative to develop suitable technologies for taking  
measurement for the advancement of ice sheets, snow cover, thickness of icebergs, thickness of ice shelf,  
Lake Floor observations etc. Tethered and un-tethered underwater vehicles plays major role in  
observations with the recent development in underwater sensor and vehicle technologies. It is possible to  
understand the ice thickness by continuous measurement and air-ice- ocean interaction studies are now  
becoming possible by using these vehicles. Hence, autonomous and remotely operated vehicles are to be  
developed for reliable operation in the challenging low temperature environment of Antarctic. These  
platforms have the potential to modernize our understanding of this remote and under sampled sea ice  
environment. In the Indian scientific context, this will be the starting step of technologies towards  
sustained observation of Antarctic ice and shallow lakes to decipher the climate forcing mechanism which  
will be highly beneficial for polar research community. These types of field-based measurements will  
bring out the state of ice cover and the potential impact on biota in extreme environment and its  
surrounding eco-system. This will also facilitate to increase our understanding of Antarctica and also to  
build our country&#39;s engineering capability towards polar science.  
In the process of technology demonstration, NIOT has developed a proto-type system of Remotely  
Operable Vehicle for polar temperature and successfully tested in Antarctic ice shelf and lakes. Critical  
challenges such as material engineering to cater for low temperature environment, under ice navigation,  
light attenuation characteristics in different continental ices, optimum vehicle design, handling systems  
etc were noted for further development or optimization. Special variant of ice coring tools were also  
developed to get interfaced with underwater water vehicle for ice core sampling below the ice shelf.  
Quantitative measurements are possible from the underwater vehicle variants to monitor the ice shelf  
dynamics, Lake Floor observations and also changes in associated biota assemblages to decipher the  
influence of climate in Antarctica.