The history of studying the internal gravity waves (IGW) in the ocean, as is known, originated in the Arctic Region after F. Nansen had described the phenomenon called "Dead Water". Nansen was the first to observe internal gravity waves in the Arctic Ocean. The notion of internal waves involves different oceanic phenomena, such as "Dead Water", internal tidal waves, large scale oceanic circulation, and powerful pulsating internal waves. Such natural phenomena exist in the atmosphere as well; however, the theory of internal waves in the atmosphere was developed later along with the progress of the aircraft industry and aviation technology. Studying the oceanic currents of the Arctic Ocean became the principal objective of the Fram expedition in 1893–1896 and was continued in the years to follow. During the expedition the scientists made a lot of observations and collected many data sheets and measurements in the Arctic which had been essentially unexplored at the time. F. Nansen was the first scientist to classify the manner in which the "Dead Water" phenomenon occurs. This phenomenon comes about from internal gravity waves generated by a slow moving vessel. The first theoretical work dedicated to internal gravity waves was the thesis by V. V. Ermak, who provided a detailed definition of dead water and systematized the data obtained by F. Nansen. The "Dead Water" effect from IGW has been long known to sailors. Sailing vessels after being caught in the thermocline (a density contrast layer) were suddenly brought down to a complete stop. This phenomenon resulted from the IGW generated by a vessel. But since then sailors saw no waves on the surface behind the ship this enormous water resistance seemed to be inexplicable whatsoever, and they blamed the bewitched drowned for holding the ship in place and not letting her go.

Modern methods of IGW investigations in ocean - asymptotical methods. Journal of Engineering Mathematics (2011). "...Applied mathematics seems, at first sight anyway, to become more and more dominated by direct numerical simulations. Admittedly, this leads to new insights which it would seem, could not have been attained by other means and many believe that asymptotics deals with exceptional cases which are usually outside the practical domain. However, this is a misconception... Does the asymptotic analysis have a future in the era of supercomputers? The answer to the question misconceptions! …Does the asymptotic analysis have a future in the era of supercomputers? The answer to the question may be: yes, of course. At the present time the 'center of mass' in research is still moving towards computations. However, along this way, it is getting more and more clear that computer simulations being applied to practical problems is not a universal panacea. Euphoria about computers is still high but a more practical point of view is becoming at least visible these days: computation is a research tool as are many other approximate or rigorous tools of mathematics which help us to gain new knowledge, understand important phenomena, solve and challenging practical problems..."

Applications. IGW in the ocean have been studied for a long time: on this subject have been published many papers in the years 1960-1980. Recently IGW studies have not attracted much attention: significantly decreased the number of IGW papers published. Recent literature investigations of IGW theory have grown up after the WW2 when the US Navy lost a few of its most advanced at the same time. Nowadays after those theses there are assumptions made that the disaster might have been caused by IGW. The submarines often move along the thermocline to avoid detection since the thermocline surface effects acoustical signals of active ocean platforms and sea vessels. The most notorious incident involved the US Navy Thresher submarine that was lost at sea in 1963 with the crew of 129 on board. This submarine was a most advanced boat in the world in the 1960s and she could descend to depths and move at velocities that were inconceivable just a few years before she was constructed. It might be that the Thresher submarine was going along the thermocline and a large IGW took her down to a depth that she could not survive.

The construction of underwater objects is necessary to constantly measure the IGW and flows: solution of IGW dynamics fundamental problem makes it possible not to do expensive IGW measurements in ocean. Special interest of IGW investigation – safety of various underwater objects (submarine, sea platforms) from moving source in ocean; underwater objects use a very long pipelines and underwater hill - stationary stratified ocean; underwater objects use a very long pipelines and underwater hill - stationary stratified ocean. Dead Water" phenomena occurred in the ocean. The interest to investigations involving IGW grew up after the WW2 when the US Navy lost a few of its most advanced at the same time. Nowadays after those theses there are assumptions made that the disaster might have been caused by IGW. The submarines often move along the thermocline to avoid detection since the thermocline surface effects acoustical signals of active ocean platforms and sea vessels. The most notorious incident involved the US Navy Thresher submarine that was lost at sea in 1963 with the crew of 129 on board. This submarine was a most advanced boat in the world in the 1960s and she could descend to depths and move at velocities that were inconceivable just a few years before she was constructed. It might be that the Thresher submarine was going along the thermocline and a large IGW took her down to a depth that she could not survive.

Main fundamental problems: i) mathematical modelling of IGW dynamics in horizontally non-uniform and non-stationary stratified ocean; ii) numerical modelling of IGW dynamics from non-local sources: sea platform and construction, underwater vessels and others; iii) asymptotic methods development for investigation of IGW dynamics in horizontally non-uniform and non-stationary stratified ocean; iv) creation of algorithms for processing the IGW measurements in ocean. Boundary condition: non-stationary stratified ocean - Dead Water" phenomena occurred in the ocean. The interest to investigations involving IGW grew up after the WW2 when the US Navy lost a few of its most advanced at the same time. Nowadays after those theses there are assumptions made that the disaster might have been caused by IGW. The submarines often move along the thermocline to avoid detection since the thermocline surface effects acoustical signals of active ocean platforms and sea vessels. The most notorious incident involved the US Navy Thresher submarine that was lost at sea in 1963 with the crew of 129 on board. This submarine was a most advanced boat in the world in the 1960s and she could descend to depths and move at velocities that were inconceivable just a few years before she was constructed. It might be that the Thresher submarine was going along the thermocline and a large IGW took her down to a depth that she could not survive.

Main results. 3D model of IGW generation by sources in ocean is constructed, the solution of the problem is expressed in terms of the Green’s function and the asymptotic representations of the solutions are obtained. Uniform asymptotic forms of IGW in horizontally inhomogeneous and non-stationary stratified ocean are obtained. Modified WKBJ method for IGW dynamics investigation in ocean is developed - ocean bottom topography and stratified ocean medium structure determine main parameters of IGW fields. IGW dynamics are strongly influenced by non-stationary ocean bottom structure. Effect of space-frequency blocking of IGW is obtained. IGW fields localized in nonstational spatial domain (canted waveguide). IGW fields propagate along the thermocline (progressive waves). Spatial domain where progressive waves propagate is depend on: density distribution and variability, IGW propagation near underwater hill and IGW far fields by pulsating sources.