Development of airborne gravimetry–Present status of arts and applications

Jiro Segawa[1]

[1] Tokyo Univ. Mar. Sci. Tech.

An attempt to measure gravity on board an aeroplane was first reported by Hans Lundberg of Canada in 1957 but it was denied by most geophysicists who believed it was impossible. In those days the largest problem to be solved first was to measure gravity on surface ships, and new gravimeters for marine use were developed such as the Askania Sea gravimeter of Germany, the LaCoste-Romberg air-sea gravimeter of the United States and the TSSG gravimeter of Japan. At this time already, the LaCoste meter was named Air-

Sea gravimeter and used on board an aeroplane by Lloyd Thompson of the United States in 1959. In any case, since the gravity measurement required accurate positionings in the three dimensional frame, most of the attempts in the airborne measurements proved to be a failure. About 10 years later, i.e., 1970s, W.R.Gumert of the United States started a helicopter gravity meaasurement in co-operation with a helicopter company for the purpose of prospecting mineral resources. He used almost all means of positionings available in those times, such as radio navigation, laser ranging, photo-theodolite and radar altimetry. He aimed at measuring gravity accurately at a limited area for prospecting. John Brozena of the US Naval Research Laboratory, on the other hand, started airborne gravity measurements using a large aeroplane such as P3C-Orion to obtain global gravity distributions to model global gravity potential. He could not use GPS at first but later employed GPS positionings positively. The accuracy of positioning by GPS was a few meters by a single positioning and a few cm by carrier phase interferometric positioning.

The development of the airborne

gravimetry in Japan was made by the author, starting in 1998 and attained a practical level in 2000. The gravimeter is named Segawa-Tokimec FGA-1, all the parts of which are Japan-made. The new recent comer in airborne gravimetry is a gravity gradiometer such as made by Bell Co. named Rotatory Gravity Gradiometer. This appears very interesting but extraordinarily expensive.

In my opinion it is important, from now on, to develop new applications of the airborne gravimetry, not merely sticking to development of hardwares. I will discuss here how we should utilize airborne gravimetry which allow us to measure gravity on the level with various height.