being developed in Canada. The program is small compared to that of satellite-launching countries but it will contribute to the advancement of knowledge made possible by the development of space vehicles. Canada's program consists of the launching in Northern Canada of sounding rockets carrying instruments, co-operating with United States groups in their extensive program in Canada, assisting in the tracking of satellites, and in the design and construction of scientific experiments to be launched in a United States satellite sometime in 1961.

The technological developments necessary to put satellites in orbit or even to launch rockets that will penetrate the atmosphere are considerable. The scientific achievements in producing these have been great but from the point of view of space science the rocket or satellite is nothing more than a vehicle and in fact is usually spoken of as such. It was developed for military purposes though it is important to note that several of the vehicles used in space science by various countries were designed solely for carrying scientific instruments and these vehicles have no practical military application.

Though there is keen rivalry between the United States and the Union of Soviet Socialist Republics to get a man into space and this rivalry appears on the surface to be political in motivation there are sound scientific reasons for so doing. With a man to operate them, scientific instruments become much more versatile, and objectives can be changed in flight using judgment that still cannot be built into a machine. No matter how complicated a machine is, judgment in programming cannot be built in where the features to be judged are not known.

An example of the advancement of scientific knowledge that can be achieved by penetrating the earth's atmosphere is a study of the radiation that reaches the earth's outer atmosphere from the sun or from outer space. For simplicity, included in the term "radiation" are both electromagnetic waves like light and clouds of rapidly moving particles such as the nuclei of atoms. The energy of these can be measured in the unit so commonly used by physicists known as the electron volt. It is a very small unit requiring 6.24×10^{18} per second to be equivalent to one watt, but the number of particles is sometimes very high. Using this unit one refers to the energy per quantum of light if electromagnetic in nature, or per single particle if a particle cloud is being considered. The realized energy is, of course, the energy per quantum or particle multiplied by a density of the quanta or particles. The quantum of light having the highest energy that can penetrate the atmosphere is about four electron volts. The energy of the most energetic known cosmic ray is about one billion times one billion electron volts (where one billion $= 10^9$). None of these radiations or particles in this enormous range of energies can penetrate the atmosphere without interacting with it in a way that changes the identity of the primary radiation. In fact, radiation in the range from four electron volts to about two billion electron volts cannot penetrate the atmosphere to sea level at all. This means that the atmosphere is completely opaque to all ultra-violet light, X-rays and low energy cosmic rays. Until the advent of rockets and satellites the existence of such radiation from the sun or sky could only be inferred by indirect measurements on some of the effects they produce, such as faint light from the night sky and aurora.

This is just an example of the advances in pure science that can be made by carrying instruments in rockets and satellites. Practical applications in expanding available radio frequencies for communication and for improving meteorological forecasting could be explained in detail but both are associated with the need for a better knowledge of the radiations mentioned above and also the chemical composition and physical state of the atmosphere at levels above about 30 miles.

The earth's atmosphere gradually merges into the atmosphere of the sun, there being no region in the environment where the density of matter is nearly as low as it is believed to be in interstellar space. This is so, even though the density of this matter is very much lower than the best vacuum that can be produced in the laboratory.

The solar atmosphere in which the earth moves is quite turbulent and the motion and the density are constantly changing. The solar gas is very hot and electrically conducting. Clouds of solar gas and a flux of energetic particles from space interact with the