from interfering molecules. But no system has been available to transfer samples between chambers while still maintaining an ultrahigh vacuum. This limitation necessitated the incorporation of all the analytical devices into one ultrahigh vacuum chamber, a trend which gave rise to an extremely expensive, multi-ported, all-in-one apparatus. The equipment lacked flexibility, and limited investigation to one experiment at a time, restricting its availability to only one scientist for the duration of the study.

Faced with the elevated costs of multi-ported, ultrahigh vacuum devices and their undesirable inflexibility, Dr. J. P. Hobson's group in the Electron Physics Section of the Division of Electrical Engineering decided to take a different course. Their idea was to build a "target transfer" system which could remove material under study from one analytical apparatus to another while maintaining ultrahigh vacuum at all times. This would allow each analytical system to be housed in its own ultrahigh vacuum, permitting all of them to be used simultaneously. Once a particular analysis was completed, the target could be moved to the next system without contamination.

"My co-workers and I began our quest in 1972," reflects Dr. Hobson. "Many problems had to be solved but the most important one was to maintain the high vacuum under conditions of movement, vibration and pumping. Vacuum equipment at that time had seals that were too large and insufficiently leak-tight. So, for the ultrahigh vacuum target transfer system new seal design and methods had to be explored. With the cooperation of a number of people including professionals, technicians, machineshop workers, design draftsmen, welders, photographers and our secretarial services, we eventually succeeded."

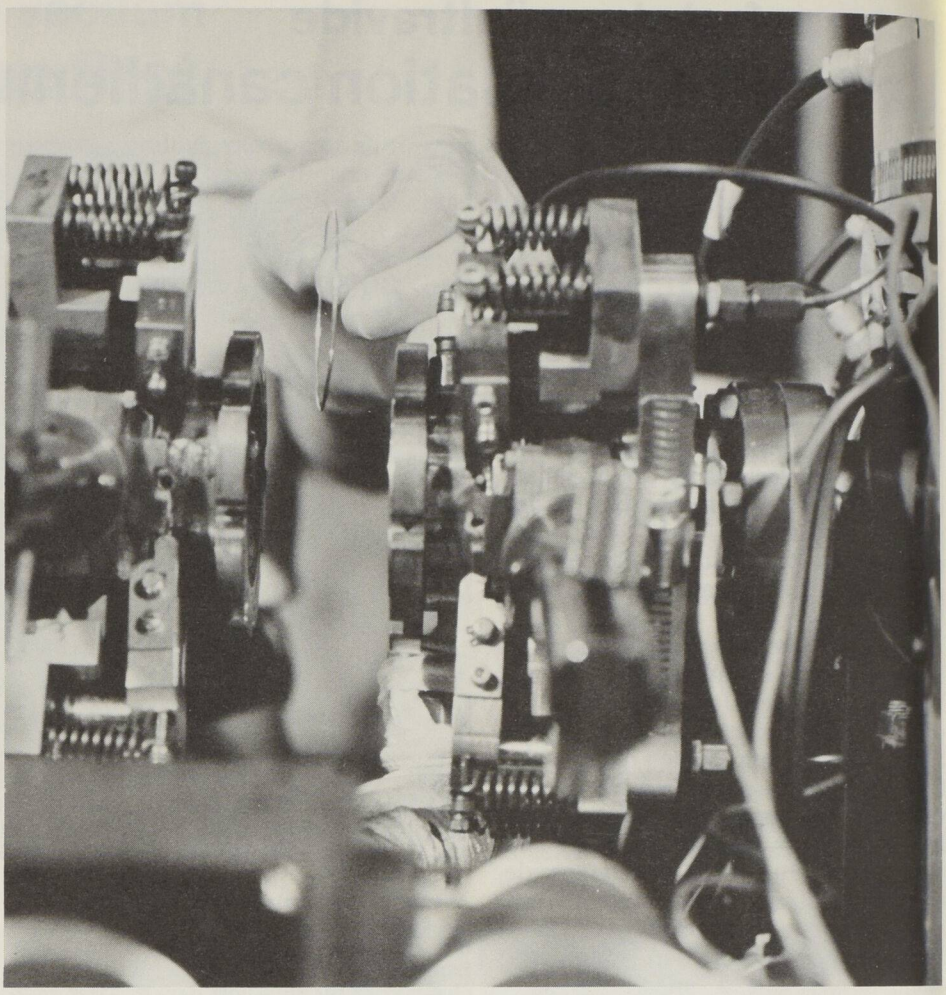
The device they built is a portable ultrahigh vacuum chamber which, in principle, can physically link up with any of the modern analytical instruments used in surface studies. After link-up the air lock is evacuated and the ports between the analytical instrument and the target transfer device are opened while maintaining conditions of ultrahigh vacuum. A tweezer-like arm from the target transfer device is inserted into the analytical instrument's chamber to grasp the target "A" under study. The arm is retracted with target "A" back into the transport device.

Another target "B" stored in the transport device can now be placed in the analytical instrument and the appropriate ports closed, sealing the chambers. When the airlock is refilled with air the two instruments are uncoupled and target "A" can then be transported to the next analytical instrument in ultrahigh vacuum, without contamination, whether it is in the next door laboratory, some other city or around the world.

"Our first transfer was achieved in 1976 when a target was removed from one analytical system and placed into another maintaining 10^{-9} torr," relates Dr. Hobson. "Although complete transfer took four hours we considered this to be quite a respectable beginning. Our design was such that the distance of transfer was unlimited. Recently, we conducted a transfer experiment which began in Ottawa, included a demonstration at an international meeting in Vienna, followed by the return to Ottawa and the reinsertion of the target into its original system. During the trip the static pressure was maintained at less than 10^{-10} torr and all transfers were completed successfully below 10^{-9} torr."

What does the future hold for this significant Canadian effort? Dr. Hobson comments: "Besides its obvious role in the field of surface physics, the ultrahigh vacuum target transfer device could be used for transporting samples back from space missions such as to the surface of the moon. Since the moon exists in a vacuum (daytime 10^{-8} torr; nightime 10^{-12} torr) compared with the earth (760 torr), accurate analysis of its surface structure requires maintaining the material in an environment free of contaminating pollutants. The compact and lightweight device can be transported by hand and therefore is suitable for space travel." □

Sadiq Hasnain



Bruce Kane, NRC/CNRC

The above photo shows a specialized seal which is positioned between the uhv target transfer device (left) and an analytical instrument (right) when they are linked together.

L'étude des propriétés réelles des surfaces métalliques ou autres matériaux exige des conditions d'ultravide ininterrompues pendant toute la durée de l'analyse. Le dispositif de transfert de cibles (ci-dessus), mis au point à la Division de génie électrique, permet aux scientifiques de transférer des échantillons d'un dispositif à ultravide à un autre, sans interruption de l'état d'ultravide. Cette série de photographies montre les différentes étapes du processus de jonction du système de transfert de cibles (à gauche) à l'appareil d'analyse (à droite).