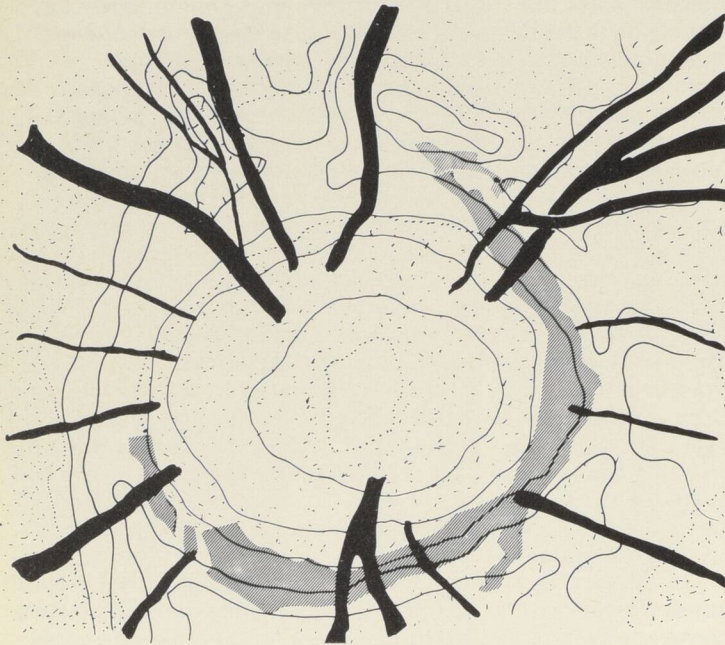


photogrammetry



Photogrammetric plot yielding positional details and contour lines of the rear portion of the eye. • Restitution photogrammétrique donnant la localisation des détails et les courbes de niveaux de la partie postérieure de l'oeil.

expensive. However, photogrammetry can provide precise and rapid measurement of the healthy limb from which the artificial limb can be exactly and automatically produced by using modern, numerically-controlled machine tools.

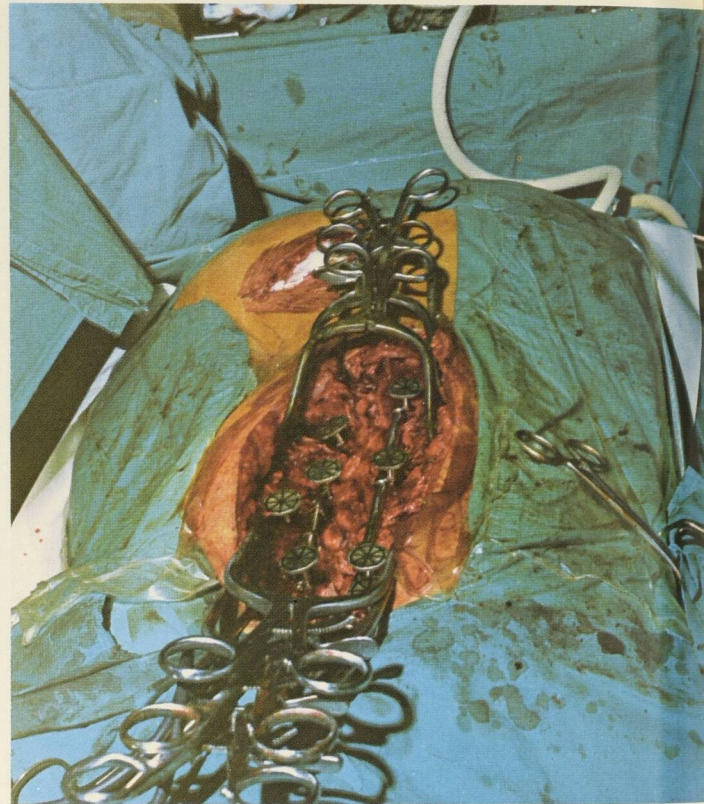
In mass manufacturing processes, such as the production of artificial limbs or mechanical parts for various types of machinery, photogrammetry provides the X, Y and Z coordinates required as input for digitally controlled milling machines. A master model of the part which is to be manufactured is photographed and its precise shape is photogrammetrically determined. This offers several advantages to manufacturers. Measurements can be taken at random, or if so required, at predetermined intervals. A permanent record of the photographed object is obtained by means of stereophotographs, which can be remeasured at any time, even after the original model has been altered or destroyed. Photogrammetric results are little affected by the complexity of the surface to be measured, which often is not the case in mechanical measuring techniques.

This technique is occasionally used by car manufacturers to design and check prototype automobile bodies. In aeronautical research, precise measurements of aircraft models tested in wind tunnels can be obtained by photogrammetric means. For this purpose, NRC scientists developed a camera permitting close-up photographs with specific optical and geometric characteristics.

Another advantage of photogrammetry over mechanical or electrical measuring systems is that it can be used for determination of shapes or deformations of fragile bodies since it does not require attaching mechanical or electrical sensors on the object to be measured and no mechanical contact between the object and the measuring tool is involved.

Transportation in North America, as in other countries, is

Photogrammetry was used during surgical correction of spinal deformation to determine the performance of the Transverse Loading System. Photograph shows photogrammetric targets temporarily attached to the Transverse Loading System. • On s'est servi de la photogrammétrie au cours d'une opération visant à corriger une déformation de la colonne vertébrale pour déterminer la valeur du Système de mise en charge transversale. La photographie montre les cibles photogrammétriques fixées temporairement au système.



plagued by safety problems. Photogrammetry, applied in studies of rapidly moving objects and fast varying situations, is an invaluable tool in the evaluation of variables in vehicular collision studies. The camera's shutter speed can "freeze" any momentary position of a moving vehicle both in special experiments or in accident situations. All the precise measurements necessary to evaluate the test or assess the cause of an accident can be extracted with the use of special instruments and a computer.

As an example, high-frequency motion pictures are used with the aid of a computer in a study of highway safety barriers currently under way at NRC. The study is designed to help determine exactly what occurs when a motor vehicle collides with a barrier and bounces back. Each of the 130 frames per second can be separately examined to determine the accurate location of any point of the car and any corresponding attitude changes expressed by pitch, roll and yaw. Thus, the complete three-dimensional path of the vehicle can be reconstructed within an accuracy of a few inches. Smooth curves also can be plotted giving attitude variations every hundredth of a second before, during and after the moment of impact.

Similar methods have been developed at NRC to support aircraft accident investigations. But in this case, only photographs taken incidentally by onlookers may be available. As a result it is much more difficult to extract precise measurements of high quality and very special procedures must be used.

Consecutive single photographs of events leading to loss of control or structural failure, and the subsequent crashing of aircraft permit the determination of the spatial position of the airplane if its dimensions are known. A sequence of photographs where available, makes possible the determination not