

(2) *New sensing devices*

A variety of new sensors, such as those listed below, have been proposed to extend the capability of the polygraph:

- (a) Infrared sensing devices for remote measurements of skin temperature.
- (b) Devices to measure breathing pattern and heart rate based upon sensitive microphones, ultrasonic or radar-type equipment.
- (c) Electro-encephalograph: A helmet mounted device with 100 sensing elements; with computer processing, this would produce an intensity modulated display of brain activity, called a toposcope. * * *
- (d) Thermistors to measure skin temperature.
- (e) Strain gage on face or jaw to measure muscle tension.
- (f) Improved blood pressure measuring devices:
 - (1) Strain gages and an EKG lead (HRB-Singer).
 - (2) Carbon microphone attached to finger tip (Texas Instruments).
 - (3) Oximeter-type device attached to ear lobe.

Among these, it will be noted, are some new sensors and some which do not have to be attached to the body. Background research to explore the possible value of new sensors for lie detection is rarely considered because their novelty is taken as *a priori* evidence of utility. In the case of new * * * sensors, it will still be necessary to demonstrate that the new physiological responses being measured actually correlate with attempts at deception.

C. RESEARCH IN RELATED FIELDS

Research of great potential value to lie detection is being accomplished in closely related fields, such as bioastronautics and medicine. No attempt will be made to summarize these efforts though the existence of several important areas will be noted.

There has been a need to monitor the physiological status of astronauts in space flight and in the experimental program associated with it, e.g., high altitude chambers, human centrifuges, protective clothing, etc. This has led to the development of new, reliable and miniaturized sensors for such responses as the cardiac pattern (EKG), blood pressure, breathing, and body temperature. Because of the need to telemeter the data from the spacecraft to ground observers, means have been developed for digitalizing the data, transmitting it to a remote receiver, and processing it automatically so that it can be read and interpreted in real time by observers on the surface of the earth. Though telemetering such data is not an obvious requirement for lie detection purposes, it provides the means (with miniaturized equipment) to conduct an interrogation under circumstances where it is desired to have the subject unencumbered with wires which restrict his movements.

There is also great current interest in using high-speed computers for better understanding of physiological, neurological, and biochemical processes. Computers make it possible to observe simultaneously many of the complex responses of the organism and to identify the significant parameters of these responses, either alone or in combination. For example, H. V. Pipberger (Mount Alto VA Hospital, Washington, D.C.) has demonstrated that 99 percent of routine electrocardiograms can be diagnosed correctly by computerized data processing equipment. The National Institutes of Health provide about \$18 million in fiscal year 1963 for medical computer facilities; the estimated amount is \$68 million for fiscal year 1964. Thus, means are now at hand to investigate many complex physiological processes on an ongoing, real time basis. This technological capability can readily be applied to improve our knowledge of lie detection by rigorous, systematic study.

8. CONTRAINDICATIONS AND COUNTERMEASURES

The emotional reactions of a person in response to certain but not all questions depend largely upon the rules of behavior being followed by the person. When there are clear, cultural distinctions between right (or truth) and wrong (or lie) attached to each answer (and assuming that the point of the question is understood equally by the interrogator and the subject), the polygraph should prove a valid instrument for most people. It is, therefore, useful to recognize that there may be several situations in which the polygraph could fail:

- (a) When the subject lacks appreciation of the difference between truth and falsity. A habituated liar (or severely disturbed personality) should not be expected to show (or indeed, "feel") emotions due to fear of detection.