ORD 1934-69

14 March 1969

MEMORANDUM FOR: Deputy Director of Research and Development

SUBJECT : Remote Physiological Monitoring

1. Recent Surveyor issues have noted reports by the Russians Gulyayev and Sergeyev claiming, respectively, that remote (wireless) electroaurograms of the human chest and electroencephalograms have been obtained. The device developed for the electroaurogram detects very weak electrical fields at a distance up to 25 cm. while the comment [redacted] on Sergeyev's work notes that "this report appears to be the first claim of brain-wave recording some 15-20 feet distant from the subject and without contact."

2. Regarding Gulyayev's work on electroaurograms, it is my personal opinion that the report is credible. Similar work, currently funded by this division, corroborates it. By means of a newly developed monitoring system consisting of whip antennae and high impedance matching circuits, electrical-field changes originating from the human body were detected. The energy of these signals is predominantly concentrated at frequencies below 30 Hz., is time varying in nature and accurately reflects both cardiac and respiratory activity, and is also quite sensitive to the distortional influences of body movement of a gross nature (motion artifact). This indirect signal is somewhat time-dependent, diminishing slightly during the first eight to ten minutes and thereafter remaining constant. Against this background of slow undulations of respiratory origin, there can be detected a more rapidly occurring event which is simultaneous with the pulse. Of greatest significance, however, appears to be the qualitative appearance of the signal. With antennae located at both the head and the feet, there is observable a wave form which is remarkably similar to that of the direct ballistocardiogram and which occurs in phase with the ballistocardiogram without a discernible lag. The first components of this pattern occur approximately 70-80 milliseconds after the R wave of the electrocardiogram. This suggests that these signals are reflecting the symmetrical expansions of the extracorporeal electrical field. The transient increase in extremely low-frequency amplitude that one obtains with bias change points to the redistribution of body surface charge which

accompanies a change in body surface area as the cause of the extremely low-frequency signal. As the skin vibrates at points where the arteries are nearest the surface and the chest wall moves with the action of the heart, a redistribution current causes a potential drop across the skin surface. This surface potential, as we have already noted, is in motion with the skin and with respect to the antenna. It is seen by the antenna as a changing E field. If an individual's skin becomes more moist due to increased perspiration or relative humidity or both, the potential decreases and so does the ELF signal.

3. It is very unlikely that streaming or bio-potential is a significant cause of ELF. If the signal is caused by a streaming potential, then a current dipole must exist along an artery or anywhere that the streaming potential is developed. It is known that when a dipole receiving antenna is perpendicular to a current dipole, the signal received is a minimum signal. Where it is parallel, the signal is a maximum one. We rotated a whip receiving antenna with respect to the brachial and femoral arteries while the limbs were within limb shrouds and with respect to the whole body outside a shroud. There was no signal amplitude change with rotation. We therefore conclude that it is very unlikely that streaming potential is a significant cause of ELF.

4. Our contractor, [redacted], has 25X1 25X1
developed prototype hardware which passively detects the above described body-generated electric fields in a typical ambient noise environment. Cardiovascular and respiratory signals can be obtained readily at a distance of eight feet, and gross movement can be detected at more than fifty feet. Our present follow-on effort with [redacted] will develop equipment featuring convenient portability, improved on-line processing techniques and readouts, increased range, and an equivalent of directional selectivity through differential detector methods. You will note that our work distance of eight feet is considerably greater than Gulyayev's reported range of "up to 25 cm." You will also note that our findings agree with his regarding the field's maximum strength, i.e. its maximum value coincides with the contraction of the heart muscle.

5. A personal evaluation of Professor Sergeyev's wireless electroencepholograms cannot be made at this time. Studies are in progress however, utilizing available low-frequency magnetometers, to evaluate his claims. The traditional assumption that it is impossible to measure emanations of brain waves remotely, would seem still scientifically prudent. Research meetings with Drs. [redacted] 25X1

and [redacted] attended by Dr. [redacted] adopted a conditional consensus to that effect. The condition was, "It's impossible but the Russians don't seem to know it." 25X1

[redacted] 25X1

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ROUTING AND RECORD SHEET

SUBJECT: (Optional)

FROM: MBSD/ORD/DD/S&T

EXTENSION

NO.

DATE 14 March 1969

25X1

TO: (Officer designation, room number, and building)	DATE RECEIVED	DATE FORWARDED	OFFICER'S INITIALS	COMMENTS (Number each comment to show from whom to whom. Draw a line across column after each comment.)
1.		14 Mar		
2. C/MBSD		14 Mar 69		
3. DD/ORD		3/17		
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