173

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AN EXPERIMENT TO EXPLORE POSSIBLE ANOMALISTIC BEHAVIOR OF A PHOTON DETECTION SYSTEM DURING A REMOTE VIEWING TEST

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ABSTRACT

We conducted a replication of work published in FY 1984 in which we experimentally examined the possibility that light is emitted in the vicinity of correctly identified remote viewing (RV) target material. In that earlier experiment, a state-of-the-art, ambient temperature, photon counting system was used to monitor the target material (35-mm slides of National Geographic Magazine photographs). The statistical measure derived from the photon counting apparatus in that study showed a significant positive correlation with the RV results ($p \leq 0.035$). That is, when the remote viewing was good, there was an increase in the signal detected by the photon counting system. In addition, we observed two anomolous pulses having a signal-to-noise ratio of about 20-40:1. In the present experiment (FY 1986), we improved all hardware aspects of the previous work, substantially reducing the background noise level, and improving shielding against artifact. In addition, analysis of the remote viewing indicates that three out of the four viewers produced independently significant results. If the probability of success is $p \leq 0.05$, the binomial probability of obtaining three out of four successful results by chance is $p \leq 0.00048$. These RV results are substantially better than those achieved in the FY 1984 study. At this time, we have not completed the detailed statistical analysis comparing the photomultiplier tube (PMT) output with the RV results. However, all data collection is complete and visual inspection of the RV trials does not reveal any large anomalous pulses. Our preliminary conclusion is that the two anomalous pulses observed earlier were the result of transients in the experimental apparatus arising from normal sources.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

Approved For Release 2000/08/10 : CIA-RDP96-00789R003800470001-9

I INTRODUCTION

We have conducted an experiment to determine whether there may be detectable physical effects correlated with remote viewing.*

A remote viewing (RV) experiment consists of four basic elements:

- A target consisting of outdoor scenes, including natural and manmade features. For convenience, experimental targets are pictures taken from *National Geographic* Magazine.
- An individual who intends to describe (by mental means alone) the target.
- A feedback procedure which displays the target.
- An *a priori* defined analysis procedure to determine if the target has been accurately described.

A single trial that encompasses these elements might proceed as follows. Using a random number generator, four targets are chosen from a pool of 112. One target of the four selected is chosen blind and the viewer is asked to give a description. After the session, the target photograph is displayed to the viewer as feedback. The description is analyzed using a Figure of Merit (FM) technique to provide a statistically meaningful evaluation.[1, 2]†

The experiment described later is a follow-on to an FY 1984 program that investigated photon production during a remote viewing task.[3] In the FY 1984 program, we conducted a conceptual replication of work published by the People's Republic of China. It was claimed that anomalous signals from photomultiplier tubes (PMT) are observed during sessions in which "exceptional vision" was successfully employed to identify Chinese language characters concealed in the PMT housing.[4, 5] Specifically, we experimentally examined the possibility that light is emitted in the vicinity of correctly identified remote viewing target material. The experiment consisted of a brief pilot phase in order to refine the protocol; a formal phase utilizing the same four individuals from the pilot phase; and a control phase consisting of two types of controls.

* This report constitutes Objective E, Task 1, detailing an experiment to determine fundamental parameters of feedback, shielding and limits of spatial resolution for RV.

† References are listed at the end of this report.

Approved For Release 2000/08/10 : CIA-RDP96-00789R003800470001-9

During the first study, four viewers were asked to contribute six viewings each. The targets were 35-mm slides of National Geographic pictures of outdoor scenes concealed within a PMT housing. Our experiments produced two apparent anomalies during RV periods, and a significant positive correlation ($p \leq 0.035$) between the quality of the remote viewing and the output of the PMT. Quality assessments of the remote viewing were performed using FM analysis. In our discussion of the FY 1984 results, we pointed out that a follow-on experiment was required, which would remove possible sources of artifact and would yield even better remote viewing. We addressed both areas in the present experiment. This interim report describes the progress that has been made.

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II METHOD OF APPROACH

A. Hypotheses and Variables

In the absence of light leaks or environmental interference, we postulate that the output of a PMT which is focused on the RV target slide is positively correlated with the quality of RV, as determined by Figure of Merit analysis. The dependent variable in the RV portion of this experiment is the overall measure of the remote viewing, i.e., the Figure of Merit. The dependent variable for the correlation portion of the experiment is the linear correlation coefficient between the FM and PMT output.

In order to demonstrate that statistically significant remote viewing has occurred, we required that the FM for a given session exceed a critical value for which the associated probablity is ≤ 0.05. The critical value of the FM was determined from the mean-chance-expectation for each viewer's session.[2] To claim evidence for a statistical anomaly, we require that the observed linear correlation coefficient between the FM and the PMT output be significantly different from the expected lack of correlation. To declare that the experiment has confirmed the hypothesis, the probability of observing the linear correlation coefficient calculated for the data from 24 viewings (four viewers, six viewings each) must be $p \leq 0.05$.

B. PMT Hardware

We utilized the photomultiplier tube light detector system and remote viewing procedure from our previous study, incorporating certain improvements as described below. The set of 112 35-mm slides of *National Geographic* Magazine sites was again used as our target material.

The PMT housing and slide holder were light-tight and constructed of metal that was grounded and shielded against rf, magnetic, and electrostatic fields. Our entire PMT housing was further enclosed in a standard photographer's film changing bag so that the slide selection and insertion could be accomplished on a blind basis.

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A light-tight slide holder, which could be opened and closed easily, had been fabricated and fitted to the end flange of the PM tube housing. The slide was positioned within approximately 2.5 cm of the active surface of the tube. This distance is 1.5 cm greater than in the previous study because the cooled tube housing was constructed with a quartz window to provide thermal insulation while allowing optical transparency into the UV.

The PM tube was selected to have an active area equal to or greater than the film area of the slide. In addition, we required the tube to be sufficiently broad band and sensitive so as to equal or surpass the device used in the first experiments by the Chinese. We also required the dark count (background) rate to be as low as possible. To achieve this goal, the PMT was cooled and the temperature stabilized at $-20^{\circ}C$ ($\pm 1^{\circ}$). This modification reduced the dark count noise by a factor of approximately 50 from the earlier study, and eliminated slow changes in the count rate caused by temperature drift.

All critical electrical apparatus (MCA, NIM bins and modules, PMT) were isolated from common mode and differential mode noise, and were protected from line surges by a Topaz power conditioner. Because the power requirements for the key experimental apparatus were too great to easily employ batteries, we surveyed the available ac voltage regulators and transient suppressors. The Topaz unit was selected as having the most modern design and providing the best specifications for transient suppression (1 kHz to 10 MHz per IEEE Standard 587), for voltage regulation (+4% to −8% for a +15% to −25% variation about 120 V), and noise rejection (130-dB common mode, 58-dB normal mode at 10 kHz).

Low level signals from the PMT to the preamplifier and preamplifier to amplifier were more heavily shielded than earlier; the preamp was close coupled to the PMT and the signal from the preamp was conducted through semi-rigid coaxial cable. (Semi-rigid coax provides good electromagnetic interference attenuation up to GHz frequencies.)

C. Signal Processing

The output of the PM tube was processed and displayed by state-of-the-art instrumentation used in nuclear radiation spectroscopy. We selected the multichannel scaling (MCS) mode of signal processing as the most appropriate for our experiment. In this type of data acquisition, the amplified pulses from the PM tube were counted for a specific length of time (dwell time), and the resulting total was stored and displayed in a single bin (channel). This process was repeated for each of 1024 channels. In this fashion, a histogram was accumulated showing the count rate of the tube as a function of time over the duration of a single viewing trial (~17 minutes). For the sake of clarity, we shall define this particular time record of PM tube output as a spectrum.

Because the voltage output of a photomultiplier tube is directly proportional to the intensity of the incident light source, we decided to set two "windows" on the PM tube signal. One window displayed the entire voltage range output which is dominated by numerous small amplitude background pulses. We designated this window Region I. The window for Region II was adjusted to show only large voltage pulses. In this fashion, we were able to monitor the system for either of two possible outcomes:

- A significant increase in the number of small amplitude pulses.
- An increase in the frequency of relatively rare, large amplitude events.

The original Chinese claim was that an individual having "exceptional vision" (an ability roughly equivalent to remote viewing) could produce an anomalous signal from the PM tube consisting of mainly large amplitude pulses.

Because the PM tube was in total darkness and no light emitting materials were included in the sample chamber, all background counts were due to thermionic emission at the photocathode or dynodes.[6] A photon striking the photocathode will produce a signal that is indistinguishable from that resulting from thermionic emission. Therefore, one cannot say conclusively whether a statistically significant increase in count rate (above background) is caused by enhanced thermionic emission or photon production. For simplicity in this report, we have referred to the putative effect as "photon production," and have calculated our results assuming that photons are striking the photocathode in the PM tube.

A multichannel analyzer (MCA) with three signal inputs received, sorted and stored the signals coming from the two windows. The third input was connected to a signal generator that could be triggered by a microswitch in the adjoining RV room. That switch was used to mark the beginning and end of data taking in the RV session. Details of the session are contained in the methodology section later in this Chapter. A schematic of the equipment used is shown in Figure 1.

Following an experimental session, the data collected by the MCA were transferred to a Sun Microsystems 3/160 computer via an RS-232 interface. In our FY 1984 study, the count rates during control periods in our two regions of interest were approximately 300/seconds and l0/seconds, respectively. By cooling the tube to $-20\,^{\circ}$C, we were able to reduce the average count rates in the regions of interest to 5/seconds and 0.7/seconds, respectively. Because a single photon can produce a count, we were sensitive to an increase of approximately $\sqrt{N}$ photons, where N is the count rate. This figure would correspond to about 2 to 3 excess counts in Region I and $\ll$1 excess counts in Region II.

D. Experimental Methodology

The slides that served as the targets during the session were prepared from a pool of 112 *National Geographic* Magazine photographs. Each slide was placed in a separate opaque envelope marked with an identification number. Prior to each session, four slides were selected from the target pool by a computer generated pseudorandom number generator (PRNG). All four slide envelopes were placed in the changing bag with the PM tube housing, then shuffled. One envelope was selected in a blind fashion; the slide was removed and then placed into the special holder covering the PMT. That procedure ensured that the slide selected was unknown to the viewer and experimenter.

The photomultiplier tube and preamplifier, the instrumentation for amplifying and counting the PM tube signals, and the computer were all located in a locked instrumentation room adjacent to the RV session room. The only form of instrumentation in the RV room was the microswitch used to signal the start and finish of an RV data acquisition period.

Prior to the arrival of a viewer, the experimenter selected the four slides using the PRNG, checked the equipment for proper functioning, shuffled the envelopes inside the PM tube bag, and loaded the target slide. In addition, the experimenter recorded a control session under exactly the same conditions as an experimental session except for the absence of the viewer. We designated these as "local" control sessions. In the planned statistical analysis, these control sessions (taken before and after the RV session) will serve as the baseline against which the experimental session will be compared.

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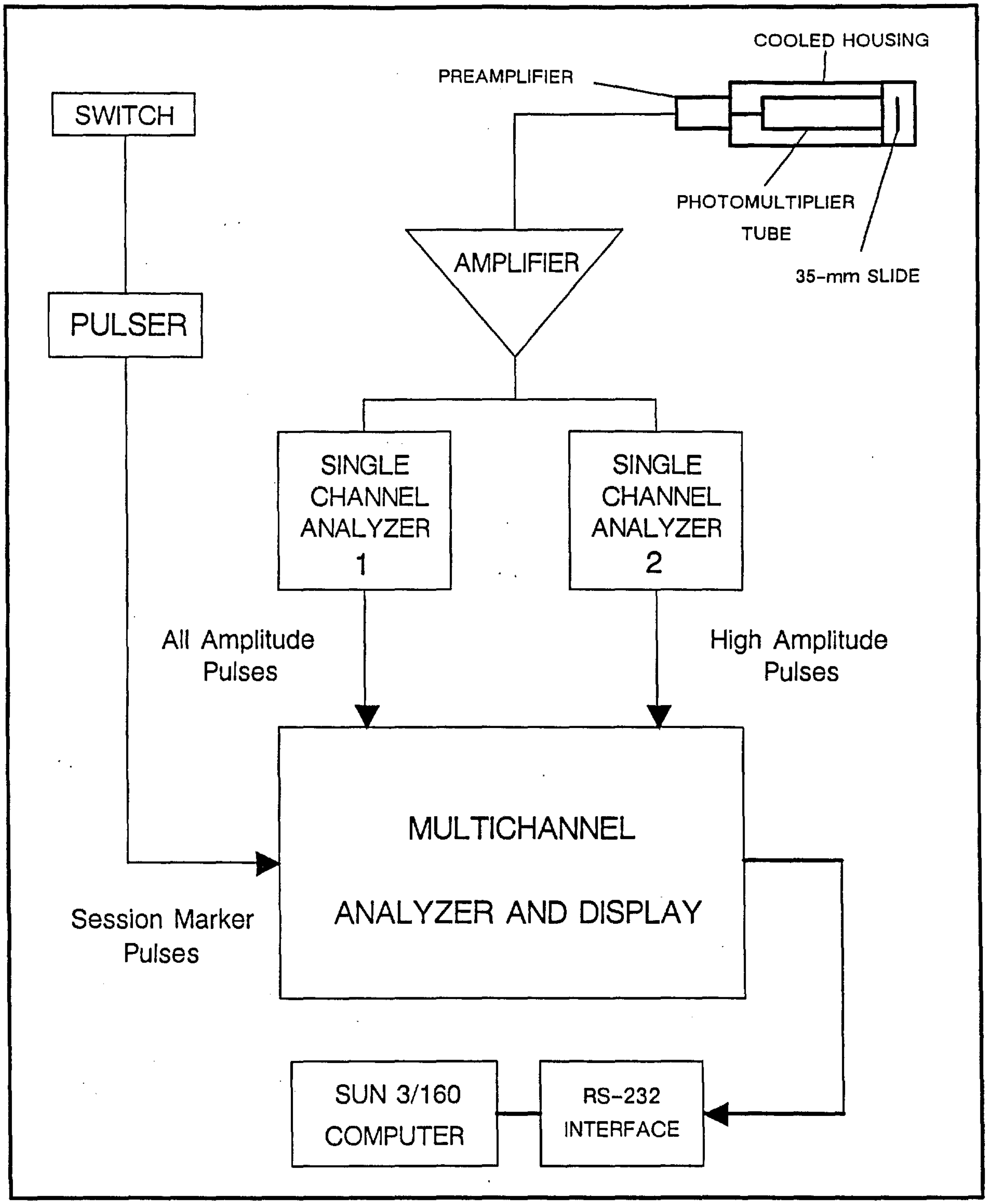

FIGURE 1 SCHEMATIC DIAGRAM FOR THE PHOTON PRODUCTION EXPERIMENT

After the arrival of the viewer, three minutes of data were collected before beginning the RV session. Each time the viewer was ready to give a response in the RV session, the experimenter marked that time with a press of a microswitch. Closing the switch briefly sent a series of TTL logic pulses which were registered in the MCA memory. After the response, the experimenter again closed the switch for 1 to 2 seconds. These two bursts of pulses clearly defined the period of RV effort for future analysis of the PMT output. A series of several such efforts using corresponding marker pairs was typically generated during each 17-minute viewing. This procedure was followed twice (i.e., viewings were conducted two at a time). Following the session, the accumulated data were automatically read out into the computer memory. Once this process was begun, the experimenter removed the target slide from its holder and displayed it to the viewer by means of a slide projector.

Following the departure of the viewer, the experimenter recorded another local control session, and then transferred all data from the computer hard disk to magnetic tape. Following the manufacturer's recommendations, all of the principal hardware (PM tube, amplifier, MCA, etc.) remained on continuously.

E. Control Sessions

Prior to any RV data collection, 50 control sessions were recorded with no one present in the experimental area. After the completion of all RV sessions, another 50 control sessions were recorded. We have chosen to call these "global" control sessions to distinguish them from the data collected before and after each RV session. As discussed elsewhere in this report, these 100 sessions will allow a very precise analysis of the parent distribution of dark counts, and will provide a good record of the maximum count rates observed under normal conditions.

As described earlier, the experimenter also recorded a control session under exactly the same conditions as an experimental session except for the absence of the viewer, before and after the RV session. These sessions were designated as "local" controls and will serve as the baseline against which the experimental session will be compared.

F. PMT Data

During a 17-minute RV trial, the typical data recorded from the PMT consist of three count rate records; we are designating these as spectra for convenience. These three spectra are displayed concurrently. Each spectrum has a common x-axis of 1024 channels.

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In order to accommodate a 17-minute trial, the dwell time was set at 1 second/channel. The first spectrum displayed all pulses from the PMT, regardless of their amplitude, that were detected during each 1-second counting period. The second spectrum displayed only those pulses--detected in the same 1-second interval--whose amplitude exceeded a preset threshold which was adjusted to eliminate all but the largest of pulses. The remaining spectrum represented RV session dependent timing markers. For the all-amplitude pulse case, the average counting rate was about 5 counts per channel (1 second). Average rates in the high-amplitude spectrum were about 0.7/channel.

With the dark count stability provided by the temperature controlled PMT, it was possible to collect meaningful baseline data. We accumulated one baseline for each RV session. Because there were always two viewings carried out at each meeting, one control session was taken before and one after the entire RV period.

Our planned statistical analysis procedure will be very similar to that used previously: a linear correlation coefficient will be computed between the FM and the number of excess (statistically significant) pulses from the all-pass and high-pass PMT data. Many viewers report perceiving RV data during rest periods as well as ostensible effort periods. Accordingly, we will look for correlations between FMs and the entire RV session PMT output, as well as the RV data acquisition periods indicated by the microswitch closures. Because the average pulse rate during this experiment was considerably less than before, a t-test comparing the average count rates in the control trials and RV trials will serve to determine whether there was any significant increase in the count rate. A second analysis program can search the RV sessions for unusually high or low pulse rates (as compared with the baseline data).

In addition, the global control data will yield the expected distribution of dark counts. These data will allow us to calculate the probability for observing a given count rate during any collection period.

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III RESULTS

A. Remote Viewing Results

Four viewers were asked to contribute six viewings each. In this experiment, the personnel consisted of four of the best viewers participating in ongoing RV programs at SRI.

Each RV session was judged using a figure of merit analysis. The FM is defined as the product of two measures: accuracy and reliability. The accuracy of an RV response is the fraction of the target material that is described correctly. Reliability is the fraction of the response that is correct.[1,2] Tables 1 through 4 show the RV results for each trial. The session number (9001.cr, etc.) incorporates a code for each viewer as well as the chronological sequence of viewings.

Table 1

REMOTE VIEWING RESULTS FOR VIEWER 009

Session	Figure-of-Merit	p-value
9001.lg	0.5714	0.0238
9002.lg	0.3810	0.1961
9003.lg	0.4444	0.0497
9004.lg	0.3333	0.3650
9005.lg	0.0667	0.9233
9006.lg	0.3556	0.2697
Overall p $\leq$ 0.0450		

Table 2

REMOTE VIEWING RESULTS FOR VIEWER 105

Session	Figure-of-Merit	p-value
9001.rs	0.4571	0.0412
9002.rs	0.1667	0.3486
9003.rs	0.1600	0.3618
9004.rs	0.3333	0.1039
9005.rs	0.0000	1.0000
9006.rs	0.3810	0.0475
Overall p $\leq$ 0.0488		

Table 3

REMOTE VIEWING RESULTS FOR VIEWER 177

Session	Figure-of-Merit	p-value
9001.hs	0.4444	0.2430
9002.hs	0.1143	0.9579
9003.hs	0.3810	0.2978
9004.hs	0.5000	0.2392
9005.hs	0.5952	0.0677
9006.hs	0.6429	0.0136
Overall p $\leq$ 0.0385		

Approved For Release 2000/08/10 : CIA-RDP96-00789R003800470001-9

Table 4

REMOTE VIEWING RESULTS FOR VIEWER 807

Session	Figure-of-Merit	p-value
9001.cr	0.0000	1.0000
9002.cr	0.3333	0.2267
9003.cr	0.5208	0.0240
9004.cr	0.0833	0.7494
9005.cr	0.3750	0.1321
9006.cr	0.1333	0.5911
Overall $p \leq 0.1895$, n.s.		

(U) From the FM analysis performed for our FY 1984 experiment, we determined that by computing the p-value for each FM we could determine an average p for each viewer and for all sessions combined. The overall probability of obtaining that average p-value was then calculated, either by an exact method for small numbers of sessions[7] or by using the central limit theorem for greater than 20 sessions.[8] In the current analysis, an additional test of significance, the Fisher Chi-square technique, has been added to supplement the probability associated with average p-value for a given series.

The overall p-values given for each viewer's series as shown in Tables 1 through 4 were calculated using the Fisher Chi-square technique. Averaging all p-values for all sessions yielded p(avg.) = 0.3437. Using the central-limit theorem, the probability associated with that average value is $p \leq 0.004$. Using the Fisher Chi-square method, a p-value of $\leq$ 0.0036 was calculated for all 24 sessions, indicating good agreement between techniques. We observed that three out of the four viewers independently produced significant results. This outcome is an extremely rare event. If the probability of success is $p \leq 0.05$, the binomial probability of obtaining three out of four successful results is $p \leq$ 0.00048. These individual and overall results are substantially better than achieved in the FY 1984 study.[3]

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B. PMT/RV Correlation Results

At this time, we have not yet performed the planned detailed statistical analysis of the correlations between the FMs for the RV data and the output of the PMT. Those calculations will be contained in the final report.

C. PMT Anomalies

In the present experiment, we improved all aspects of the previous work, including quality of remote viewing, background noise level, and shielding against artifact. As mentioned above, we have not yet completed the detailed statistical analysis comparing the PMT output with the RV results. However, all data collection is complete and visual inspection of the RV trials does not reveal any anomalous pulses.

Approved For Release 2000/08/10 : CIA-RDP96-00789R003800470001-9

IV DISCUSSION AND CONCLUSIONS

We conducted a replication of work published in FY 1984 in which we experimentally examined the possibility that light is emitted in the vicinity of correctly identified remote viewing target material. In that earlier experiment, a state-of-the-art, ambient temperature, photon counting system was used to monitor the target material (35-mm slides of *National Geographic* Magazine photographs). The statistical measure derived from the photon counting apparatus showed a significant correlation with the RV results ($p \leq 0.035$). That is, when the remote viewing was good, there was an increase in the signal detected by the photon counting system. When the viewing was less accurate, a smaller signal was detected by the counting system. Out of 22 viewings, we recorded two which contained a photon counting anomaly having a signal-to-noise ratio of about 20-40:1, far below the 100-1000:1 anomalies reported in the Chinese literature that motivated our original study.

In our FY 1984 experiment we concluded that:

> "Since we observed both statistical correlations and two suggestive anomalies, we have concluded that there is sufficient evidence to justify another set of experiments. To carry out a more definitive investigation, those experiments should be conducted with the following improvements:
>
> - Add more-experienced viewers to the initial group.
> - Cool and temperature stabilize the PM tube to reduce background noise count rates.
> - Introduce yet more stringent electrical isolation from the environment to further reduce the possibility of artifacts from electrical transients."

In our present experiment we have satisfied all of the foregoing recommendations and have improved all aspects of the previous work--including the quality of remote viewing, background noise level, and shielding against artifact. At this time, we have not completed the detailed statistical analysis comparing the PMT output with the RV results. However, all data collection is complete and visual inspection of the PMT output during RV sessions does *not* reveal any large anomalous pulses. Our preliminary conclusion is that the pulses observed in our earlier experiments and in the Chinese work were the result of transients in the

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experimental apparatus, which have now been suppressed through the use of power conditioning, EMI hardening, and temperature stabilization.

Approved For Release 2000/08/10 : CIA-RDP96-00789R003800470001-9

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