Preliminary Critique

on

Final Report-Bloodstain Analysis System (FR-2700-101)

which was prepared by Beckman Advanced Technology Operations for the Aerospace Corporation, Subcontract 67854, FR-2700-101, July, 1978.

The following pages were hastily prepared in response to a request by Mr. Robert Burkhart, Director of Research Programs, NILECJ-LEAA. In form and content, this report is a rough draft. It is intended as a preliminary report and is by no means complete.

Submitted by

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CHRONOLOGY OF EVENTS

The following chronology is offered as a framework of reference.

August, 1976 — Beckman Instruments, Inc. submits a proposal "Electrophoretic Bloodstain Analysis Program" in response to a subject solicitation from the Aerospace Corp. dated June 28, 1976. Beckman ATO was assisted in the preparation of this document by Dr. Benjamin W. Grunbaum.

Oct.11, 1976 — A letter is sent from Beckman to Aerospace to document all clarifications and modifications made in the above proposal as a result of a formal request by the Aerospace Corporation. Among its specific requests, Aerospace asked for a guarantee" that Dr. Benjamin W. Grunbaum would be part of the subcontract in support of technical development. Beckman responded that the University of California had committed Dr. Grunbaum to this program.

Beckman was eventually awarded a subcontract (No. W-67854) by the Aerospace Corp.

Beckman, in turn, granted a subcontract (No. Z847905) to the University of California.

Jan.10,1977 — The Beckman-U.C. subcontract became effective and work was begun at the White Mountain Research Station laboratory on the Berkeley campus.

Sept., 1977 — A subcontract amendment from Beckman extended the subcontract for an additional nine months from 9-30-77.

Oct., 1977 — B.W. Grunbaum, Project Director at the White Mountain Research Station, applied to the Campus Research Office to seek immediate termination of the Beckman-U.C. subcontract. Reasons for this action are discussed later.

Nov.4, 1977 — At the request of the Campus Research Office, Beckman Instruments issued a Revised Statement of Work which freed the University of any further effort under the subcontract after Nov. 15, 1977, except for a draft Final Report to be completed by December 15, 1977.

Nov.10, 1977 — Letter to the Univ. laboratory from J.L. Morgan, Senior Contract Administrator, Beckman Instruments,

CHRONOLOGY OF EVENTS, continued

containing the following statement:

"Subcontract Task 5.2.a., System Definition has been satisfactorily completed including the standardized methodologies."

Jan. 10, 1978 — Letter to Dr. B. W. Grunbaum from J. L. Morgan stating that the U.C. Final Report has bean received and releasing the University from any further technical effort under subcontract task 5.1.2c (Final Report).

July, 1978 — Final Report-Bloodstain Analysis System submitted by Beckman to the Aerospace Corp. and accepted.

Sept., 1978 — Announcement of grant from LEAA in amount of $203,140 to the Forensic Science Foundation to conduct workshops for forensic serologists to learn the BAS at the Serological Research Institute in Emeryville, Calif.

Dec., 1978 — The above workshops begin at SERI.

Dec., 1978 — After many months of effort and many refusals, I obtained a copy of the Beckman Final Report. After reviewing this document, I urged LEAA not to accept it for the following reasons:

1. The claims that the contractor has met the Statement of Work are unsubstatiated and, in some instances, false.

2. Data purportedly generated during the System Development Phase at the University of California has been misinterpreted, manipulated, and falsified.

3. Insufficient supporting data has been given in reference to Feasibility Testing and Crime Laboratory Demonstration Testing.

The Beckman-Aerospace Bloodstain Analysis System has acquired a false aura of success for several reasons:

1. The Aerospace Program Manager has permitted very grave changes, misrepresentations and omissions of the Statement of Work. These have not been officially acknowledged or approved, just somehow "overlooked".

2. The Aerospace Corporation has accepted from Beckman Instruments, Inc. a Final Report that is unscientific and basically dishonest in content.

3. A Beckman consultant traveled to scientific meetings for a period of well over 15 months to proclaim the "success" and extol the virtues of the BAS. His unsuspecting audiences felt confident in accepting the validity of research done at the University of California, monitored by the Aerospace Corporation, and supported by LEAA.

4. The Aerospace Project Director was open in his praise of this methodology long before it was submitted for testing.

5. Mr. John Sullivan of LEAA has openly extolled BAS even before the Final Report has been accepted by LEAA, even to the extent of writing a letter in its praise to an official of the California OCJP.

6. LEAA has granted money for workshops to teach this "new methodology" even before the Final Report was accepted by LEAA and made available to the forensic science community for evaluation. These workshops are already in progress.

7. These workshops are well attended by crime laboratory personnel since LEAA is paying most of their expenses. In good faith, these people assume that LEAA has made a careful evaluation of this and alternate methodologies and is offering them the best currently available methodology. Since most, if not all, of the participants have little or no basis for comparison, they will be pleased with and defensive of whatever new skills they acquire.

The Aerospace Corporation, in its Statement of Work for a Bloodstain Analysis System (BAS), specified that the effort of the contractor "shall result in the improvement of currently available (bloodstain analysis) methodology in the areas of speed, operator skill requirements, and interpretations of analysis results. It shall also extend the state of the art as permitted by long-range detectability and a higher degree of discrimination."[1]

The "system" presented by the contractor, Beckman Instruments, Inc.,[2] does not meet these requirements. The basic methodology does not differ in any significant way from the "currently available methodology". The "gimmick" of simultaneous analysis of eight constituents on three plates is an innovation that can only compromise and further complicate already complex analytical procedures. Skill requirements must be increased. Time required to learn the methodology and to learn to read results must be increased. Sensitivity, accuracy, and reliability must be sacrificed for whatever time may be saved by simultaneous analysis.

The development of this BAS came about as the result of an arbitrary administrative decision at the Beckman/Aerospace level in regard to the direction of research. The University of California, subcontractor[3] to Beckman for support of technical development for the BAS, withdrew from the project in protest to the arbitrary decision. The remaining developmental tasks were turned over by Beckman to two individuals who were unqualified both in terms of education and research experience.

The misrepresentations in the Beckman Final Report are an attempt to justify a methodology that does not meet the contractual Technical Requirements of the Statement of Work. Misinterpreted data, incorrect data, and false data are offered in support of the arbitrary administrative decision which determined the direction of research.

Since the "success" of the Beckman-Aerospace BAS project remains totally unsubstantiated, it is incumbent upon LEAA to subject the Beckman Final Report to the careful scrutiny of forensic scientists who are well-versed in research methodology. This review should measure the reported results in the Final Report against the objectives and technical requirements established by contractual agreement. It should compare the "supporting evidence" which is presented in the Report with the original base data and with earlier "official" reports to the Aerospace corporation.

The pages which follow do not contain a complete and definitive analysis of the Final Report. A voluminous document pinpointing every unsubstantiated statement or questionable bit of misinformation is unnecessary as a guide to a qualified and objective review panel.

DOCUMENTATION

A review panel will require the following documents, which can be obtained from the contractor, THE AEROSPACE CORPORATION:

1. Program Plan, Electrophoretic Bloodstain Analysis Program, Subcontract No. W-67854, Beckman Project 1361-2700-800, Submitted to The Aerospace Corp. by Beckman Instruments Inc., Applied Technology Operations. Feb. 11, 1977.

2. Subcontract Z-847905 (Beckman-Univ. of California). This subcontract became effective on Jan. 10, 1977. The subcontract consists of the following items:

   *Faceplate-Beckman form

   *Subcontract Schedule, Including Articles 1 through VIII

   *Attachment "A" Statement of Work, dated 10-17-76, with Annex "C" (Technical Requirements) and Tables I and III.

   *Attachment "B" General Provisions, dated 10-8-76

3. Change Notice #1 to Beckman Subcontract Z-847905

4. Change Notice #2 to Beckman Subcontract Z-847905.

5. Revised Statement of Work for Beckman Subcontract Z-847905, dated November 4, 1977.

6. The original fifteen notebooks containing base data generated during the developmental phase of the project at the University of California until Nov. 11, 1977.

7. All other original research data generated in support of the BAS project after Nov. 11, 1977.

8. The official Feasibility Test Plan prepared by Beckman ATO and approved by The Aerospace Corp.

9. Original records of all data generated in performance of the Feasibility testing.

10. Official Feasibility Demonstration Test Report prepared by Beckman ATO and submitted to The Aerospace Corp.

11. Official Crime Laboratory Demonstration Test Plan prepared by Beckman ATO and submitted to the Aerospace Corporation for approval.

DOCUMENTATION, Continued

12. Original records of all data generated in performance of the crime laboratory demonstration testing.

13. Official Crime Laboratory Demonstration Test Plan Report sumitted by Beckman ATO to Aerospace for approval.

14. Official copies of all Monthly Progress Reports prepared by Beckman ATO for the Aerospace Corp. The first 10 of these reports cover the developmental period under U.C. subcontract. These were prepared by Jean Bordeaux of Beckman ATO. Presumably, there were monthly progress reports after the 10th report, but I have not had access to them.

15. Official copies of the Minutes of the Program Review Meetings attended by individuals concerned with this project from The Aerospace Corporation, Beckman ATO, and the Univ. of California. The first three of these Minutes were prepared by Mr. Gerald Roberts, Program Manager, Law Enforcement and Telecommunications Division, The Aerospace Corp. (These were dated Jan. 18, March 15, and May 4, 1977.) Subsequent Minutes (for June 20, August 9, October 3) were prepared by Dr. Robert Shaler, Director, Forensic Sciences, The Aerospace Corp. Presumably, Progress Review Meetings continued after the project left the University, but I have had no access to the minutes of these meetings.

16. Final Report-Bloodstain Analysis System, prepared by Beckman Advanced Technology Operations, for the Aerospace Corporation, Subcontract 67854, July, 1978. FR-2700-101

ROLE OF THE UNIVERSITY OF CALIFORNIA
(Final Report, Preface, p. v.)

Page v contains two misrepresentations relevant to the University of California. The first concerns the organizational relationship established by contract between Dr. Grunbaum of the University, management at Beckman ATO, and consultants paid by Beckman. The second concerns the circumstances leading to the termination of the U.C./Beckman subcontract.

(1) The Beckman PROGRAM PLAN clearly defines the organizational structure (see attachment A).[4] The University contracted to "provide ... services as required to perform the technical effort defined in the Statement of Work ... and fulfill all other requirements specified in a Beckman-U.C. subcontract."[5] The subcontract states that "Benjamin W. Grunbaum (Research Biochemist) and Professor Nello Pace, Co-Principal Investigators, are considered key to the successful completion of this effort."[5]

The subordinate relationship of the Beckman consultants to the research effort is clearly stated in the Program Plan[4] and in a letter (see attachment B) from Mr. Jack Walsh to Mr. Brian Wraxall.

When the project left the University of California, the remaining tasks were turned over to two individuals who were lacking in either the educational training or the research experience to qualify them for the responsibilities they assumed.

(2) The UC/Beckman subcontract was not terminated "after approximately nine month's work" because "Dr. Grunbaum's support was no longer required".[6] In fact, Beckman ATO renewed the subcontract at the end of nine month's work for an additional nine months. A week after that renewal, Dr. Grunbaum initiated termination of the subcontract for the reasons stated in the attached document addressed to the Campus Research Office (see attachment C).

This misrepresentation seems designed to conceal that there was an irreconcilable difference of opinion in regard to direction of research.

MISREPRESENTATION OF DATA
(Final Report, Blind Trials, pp. 3-1 through 3-13)

BLIND TRIALS

Section 3.0 should be of particular disappointment for those who have waited to see the "test results" which, in the words of J. L. Morgan, "showed conclusively that to meet the goals of the Statement of Work within the contract budget it was mandatory that we (Beckman) proceed with the most promising system." (see attachement D).

The data that are presented concerning three series of so-called Blind Trials would be considerably more meaningful if the authors reported when (and why) the tests were done, who designed them, who carried them out, who monitored them, who recorded the results.

A. Series I Tests for Detectability of EsD (Tables VI, VII)
Series I Tests for Detectability of EAP (Tables IV, V)

These so-called "Series I" tests were done in May and June, 1977. They were done in a casual, unmonitored, and completely unscientific fashion, strictly for the education of the participants. There was no intention to use these tests as a basis for decisions concerning selection of substrates. Yet, while I was in Europe on behalf of the American Academy of Sciences, Tables showing "results" for detectability of EsD and EAP were prepared and presented at a Progress Review Meeting (June 20) by the Beckman consultants who were working under my direction. I objected to the presentation of this material and to the interpretations and conclusions made by the Beckman consultants for the following reasons:

1. The blind trials were poorly designed.

a) The so-called "sensitivity tests" were not relevant to the Aerospace-Beckman Statement of Work. The reduction of sample size is an unjustified modification of the technical requirement of the Statement of Work. The Statement of Work specifies that "the method used shall be capable of performing the complete analysis on stain sizes equivalent to 50 microliters of fresh blood without consuming more than half the sample.."[7] The extreme and uncalled-for reduction of sample size undoubtedly led to the high percentage of error which rendered these tests valueless.

b) The "sensitivity tests" were made on the false assumption that extracted bloodstain dilutions and length of stained thread can be equated.

c) No effort was made to guarantee that the blind trials were truly "blind". Samples were taken from laboratory personnel and from the OCJP population survey without any guarantee that the readers did not have access to results of previous phenotyping of these bloods. Individuals who prepared samples and recorded results also served as "readers".

d) The blind trial tests were not monitored.

e) Two "readers" had no experience with cellulose acetate (CAM) and the other two had no experience with either CAM or starch gel with bloodstains.

2. The tests were premature. Nearly three months remained in the methodology development phase of the program. There was no reason to do comparison studies of methodologies still under development.

3. EAP blind trials were made in my absence, without my supervision, and the results were presented to the Aerospace Corporation without my review. Full responsibility for the accuracy, reliability, and scientific worth of data coming from the University laboratory rested with me. I did not and could not assign this responsibility to the Beckman consultants.

To this point, Tables Iv, V, VI, and VII might be excused on the basis of ignorance on the part of the authors who decided to put them in the Final Report. However, there is a more serious indication that data was manipulated for the convenience of the authors.

A case in point are tables VI and VII. The same tests were first reported"officially" to the Aerospace Corporation by the Beckman consultants at a Progress Review Meeting, June 20, 1977. The tables presented at that time must be compared with those in the Final Report. Most surprisingly, the results of one reader have been removed from the later tables. These changes radically affect the comparative results. The reason given for eliminating the readings of one individual do not appear valid since the same reader is allowed to participate in later "blind trials" on EAP and his readings are included.(Incidentally, the reader was censored myself, the director of the project.) Of course, any research scientist is aware that this sort of "editing" is not permissible; it is basically dishonest to retain one individual's "readings" when they please the experimenter, but disregard or discount them when they do not support the experimenter's bias.

B. Series I Test - PGM - Detectability of Dried Stains (Table VIII).

Attachment E

Table VIII appears to contain falsified data. While the other so-called Series I test results were presented at the June 20 Program Review Meeting, no Table for PGM was given. The Monthly Progress Report, July 11, 1977, Attachment F states that for a six week period the laboratory had been unable to get satisfactory results with PGM on either starch or CAM and the problem was not yet solved. The August 8, 1977, Progress Report cheerfully reports that the problem with PGM had now been solved and "It was decided to repeat the (EsD and EAP) trials that were conducted in June and also to conduct one on PGM which at that earlier time was causing considerable difficulty".

Zeroxed copies of the laboratory notebooks for June show repeated failure to get readable results for PGM of starch gel. There is no record of blind trials for PGM on CAM. Table VIII appears to be largely fabrication and prevarication.

Specifically, blind trials were reported for CAM for which there is no documentation. "No test" was reported in six instances for starch gel when in fact the tests were attempted and the results were unreadable.

Table VIII indicates that Blind Trials were made for PGM on CAM on bloodstains of decreasing size (0.7, 0.5, 0.35, and 0.18 µl) on stains 24, 31, and 42 days old. There is no record in the notebooks that such tests were ever made. Customarily the "blind trial" readings would have been entered in the "Detectability " notebook and the original membranes would have been filed and identified in the PGM notebook in the proper sequence.

What notebooks? Dates

Table VIII indicates that no Blind Trials were made on starch gel for bloodstains on two threads and on one thread (equated by Beckman as equivalent to 0.35 and 0.18 ul whole blood). What is the rationale for conducting a comparison test in which only one substrate is tested? No explanation is given.

A glance at the laboratory notebooks will give proof that Table VIII is deceptive. Blind Trials were attempted on starch gel for all the specifications (4 x 0.5, 3 x 0.5, 2 x 0.5, and 1. 0.5). The results of these tests were entered into the PGM notebook by Beckman Consultant Mark Stolorow, as follows:

PGM 36, June 15, 1977, 3 threads, "negative results - no photo. ."

PGM 37, June 15, 1977, 2 threads, "negative results - no photo. ."

PGM 38, June 15, 1977, 1 thread, "negative results - no photo".

PGM 40, June 16, 1977, 4 threads, photo attached

(Mark Stolorow "read" the seven stains exactly as they appear on the Blind Trial record in the Detectability notebook. However, this determination was made on 6/16 and the "Blind Trial" was made on 6/21.)

PGM 41, June 16, 1977, 3 threads, "minimal activity, no photo. . "

Two more blind trial entries were made by Brian Wraxall, as follows:

PGM 42, June 21, 4 threads, no results recorded, "no photo"

PGM 43, June 21, 3 threads, no results recorded, "no photo".

In comparing the data in the PGM Laboratory notebook and the "Detectability" laboratoy notebook with Table VIII, several facts emerge:

1. There is no evidence that any tests were performed using CAM.

2. Three blind trials were attempted using three threads with starch gel (June 15 - "negative results - no photo. ."
   June 16 - "minimal activity - no photo. ."
   June 21 - no comments, no photo.

   Which of these blind trials is reported in the Detectability notebook and on Table VIII? How could any readings be made when activity was so minimal that photography was impossible? How can this data be acceptable when there is not the substantiating evidence of a photograph?

3. Two blind trials were attempted with four threads on starch gel. The first of these, on June 16, has a photo and a correct reading of the first seven samples. The second, on June 21, has no photo. On which date were the alleged readings on Table VIII made? The age of stains on Table VIII would be incorrect for June 16. There is no photographic supporting evidence for June 21? And if Stolorow had already read the stains on June 16, how could he be a reader for the same stains on June 21?

4. In six instances, the words "no test" were entered on Table VIII for the starch gel substrate. Laboratory records show that these tests were attempted, with minimal or unsatisfactory results. Laboratory records show that several unsatisfactory tests were also made with the Blind Trials which were reported.

Table VIII appears to report CAM Blind Trials that were not made and appears not to report starch gel unsuccessful blind trials.

It must be recognized that the data in Table VIII, even if it were honest, are of no scientific importance. The spurious Series I blind trial for PGM and the Series I tests for Esp and EAP are put into the Final Report only to bolster the false claim that administrative decisions concerning direction of research were based on "test results". The detailed analysis of these tables that appears in the Final Report is, of course, as dishonest as the data on which it is based.

Blind Trial Series 3 (Table X)

I participated in the second and third series of tests as a reader and observer only. Recordings of results and preparation of tables* were done by the Beckman consultants and Beckman Program Manager.

Series 2 was carried out in July, 1977. The "official" results (Attachment G) show that on all the substrates the variants of all three constituents were identified with a high degree of accuracy. The "official" Beckman analysis (attachment K) of this data concludes with a remark of considerable interest:

> "On cellulose acetate there was a total of 264 readings. Out of these was a total of 4 called incorrectly and a total of 8 questioned. The four incorrect calls made on cellulose acetate were all made by the same reader. Seven of the 8 questioned calls were also made by the same reader."[8]

This reader was Beckman consultant Brian Wraxall.

(Footnote)

I am attaching 4 tables prepared by the Beckman consultants and Program manager, as follows:

1. Attachment G: A table showing "official" results of the second series of blind trials, Beckman Monthly Progress Report to the Aerospace Corporation, August 8, 1977, page 4.
2. Attachment H: table showing results of the same (second) blind trials from the Beckman Final Report, July 1978, p. 3-10.
3. Attachment I: A table showing "official" results of the third series of blind trials (confirmation tests) from the Beckman Monthly Progress Report to the Aerospace Corporation, September 8, 1977, p. 4.
4. Attachment J: Table showing results of the third series of blind trials from the Beckman Final Report, July 1978, p. 3-12.

Series 3 was carried out in August, 1977. "Official" results (attachment I) show that the methodology using CAM was well within the 90% accuracy requirement. EAP, PGM, and GLO I were run on starch gel with some loss of accuracy.

The tables from the Beckman Final Report (attachements H and J) which purport to give the results of the second and third series of blind trials should be examined carefully and compared to the tables (attachments G and I) prepared by the same individuals and submitted to the Aerospace Corporation a year earlier. In the attached copies, all omissions, additions, and changes have been marked with a circle. With one exception, there is no explanation for these changes. Are the original tables, or the final tables, or both, examples of sloppy reporting? Or are the changes deliberate? Base data from the laboratory notebooks should be examined to reach some approximation of the truth.

Some questions that might be posed?

1. Tests appear in final tables IX and X which are missing in the earlier official tables. Where did they come from?
2. All incorrect responses have disappeared from both tables. Why?
3. What is the logic, in a comparison test, in running determinations and reporting results for one substrate and not the other?
4. In Table X, is not "insufficient separation;No test" a contradiction in terms?
5. Why in Table X, is it reported that no repeat was made for a particular determination when in fact it was repeated, with four out of a total of four readings correct?

The answers to these questions may show something concerning the carefulness or basic honesty of the individuals preparing the tables.

Actually, the entire section on Blind Trials in the Final Report is a smoke screen to conceal the real issue. In July and August of 1977, either substrate showed sufficient sensitivity to meet the Technical Requirements of the Statement of Work. What was at issue were other technical requirements, in particular, that requiring simultaneous analysis. At that time, I was insisting that even if results were "readable" under carefully controlled laboratory conditions, simultaneous analysis represented a serious compromise in methodology that would be a detriment in the analysis of biochemically fragile bloodstain evidence.

An arbitrary administrative decision was made to adhere to the rigid concept of "simultaneous analysis". The blind trials, which are worthless as scientific measurements, and which are not even presented honestly, are included in the final Report and discussed in great detail, to justify this decision.

A casual reader might assume, reading a paper dealing with methods for simultaneous determination on aged bloodstains, that the photos of the eight phenotypes will illustrate the success of that methodology. However, nowhere in the text or in the labeling of the pictures is there any statement that the determinations on gel were made by simultaneous analysis of dried bloodstains. Apparently they were not.

The authors make much of the fact that their methodology permits analysis of eight samples and one control at a time. Yet the photos for GLO, EsD, PGM phenotypes (Group I) show only 4 samples; the ADA phenotype shows 8 1/2 samples; the EAP phenotype shows 10 samples; and the AK shows 9 samples (Group II); the Gc shows 3 samples, and the Hp shows 6 samples (Group III). There is no explanation for this. The pictures vary in size and there is no point of reference that might help one to determine whether or not the photos have been cropped. These photos are so lacking in style and professionalism that they are laughable. Yet the lack of adequate labeling suggests a deliberate intent to deceive.

Figure 2, Examples of PGM on Bloodstains using CAM, is supposed to look very bad; for no discernable reason the photo is greatly enlarged to produce a grotesque distortion.

Figure 3, Examples of EsD on Bloodstains Using CAM, is in no way characteristic of the determinations routinely obtained in the University of Calif. laboratory at the time the BAS project was in progress here. Picture 14 is pointless. The authors are correct in their assertion that the application of sodium carbonate glycine enhances a determination more than an application of glycerol; they fail to mention that the sodium carbonate glycine will also almost immediately destroy the electrophoretic pattern! This picture and the comments about it do not appear relevant.

UNSUBSTANTIATED CLAIMS - "AS GOOD OR BETTER"
(Final Report, System Development, Interpretation,
pp. 4-19 thru 4-31)

The authors chronicle trial-and-error attempts to analyze two or more variants simultaneously on a single substrate. One such substrate was decided on for Group I and another for Group II. No common supporting medium could be found for the two remaining variants, Hp and Gc. Finally, the researchers resorted to another gimmick. They developed a method for simultaneous analysis of these two variants by dividing the gel plate in half and filling each half with a different gel mixture. This ridiculously complicated procedure has no point other than to bolster the researchers' false claims that eight variants are analyzed on three (undefined) "setups".

In the final part of the SYSTEM DEVELOPMENT section, the authors set out to "prove" the patently absurd hypothesis that as "good or better" resolution

can be obtained with the simultaneous analysis they propose than with optimal individual analyses. The "proof" is, first of all, eight photographs* (Figures 9 ~~through~~ 13, 15-17). We must assume that the analyses pictured were not run simultaneously since neither the text nor the captions give this rather pertinent information.*

The authors compare the 8 photographs of electrophoretic separations with some undefined "something" cited in 16 different references. The authors proclaim the BAS separations "a substantial improvement", "equivalent to", "better than", etc.

As an example: "The three ADA phenotypes are shown in Figure 12. The separation between the isoenzymes is as good, if not better, than the method of Culliford (1971)." The LEAA reviewer has two choices: (1) He may accept the subjective evaluation of the authors. (2) He may obtain this particular reference and look for something, possibly a photograph, to use as a basis of comparison. The LEAA reviewer must of course accept on faith that the method of Culliford (1971) is the best alternate method to be found in 1978 for the analysis of ADA in four-week-old bloodstains.

Of course, if the LEAA reviewer chooses the second course, i.e., to obtain copies of all 16 of the references and compare them with the eight photographs, the LEAA reviewer himself must be a considerable expert in electrophoresis.

Perhaps some more scientific means of comparing methodology is possible.

* It is indeed surprising that while a major requirement of the project is to phenotype stains up to 4 weeks old, not a single photograph is included to show BAS results with bloodstains.

UNSUBSTANTIATED CLAIMS -TECHNICAL REQUIREMENTS
(Final Report, Conclusions, p. 6-1)

After a review of the completed program, the authors conclude that the technical requirements have been satisfied.[12] This is not true.

Certain of the technical requirements from the official Statement of Work[11] are quoted below in bold type.

1.1. SPEED OF ANALYSIS

THE MANPOWER NEEDS FOR THE PROCEDURE FROM RECEIPT OF THE STAIN AT THE LABORATORY TO THE READING OF THE ANALYSIS RESULTS SHALL NOT EXCEED FIVE (5) MAN-HOURS. PERIODS OF TIME DURING WHICH OPERATIONS PROCEED UNATTENDED ARE NOT COUNTED FOR THE PURPOSE OF THE MANPOWER REQUIREMENT. THE ELAPSED TIME FOR THE ENTIRE PROCEDURE SHALL NOT EXCEED TWENTY-FOUR HOURS.

Not proven.

Statements made in the Feasibility Test Report and not substantiated by data. For instance, who kept the time log.[?] What was included in "run time". Preparation of gels? Cleanup? Photographing of electrophoretic plates?

No data concerning "hands on" or "run" times were collected from the crime laboratory demonstration tests where the work would be done by personnel with considerably less expertise than the individual who ran the Feasibility test.

SOW 1.2 SKILL REQUIREMENTS

THE METHOD TO BE DEVELPED SHALL BE CAPABLE OF BEING LEARNED IN TWO WEEKS AND RELIABLY USED BY TYPICAL CRIME LABORATORY TECHNICIANS WITH APPROXIMATELY TWO YEARS OF COLLEGE-LEVEL CHEMISTRY, INCLUDING ORGANIC OR BIOCHEMISTRY, PLUS ONE YEAR OF APPLICABLE SEROLOGICAL EXPERIENCE.

Not proven.

Nothing in the Report indicates the educational background of the personnel selected to be trained in this methodology, nor their responses and time required for proper identification of bloodstain phenotypes.

SOW 1.3 HAZARDS

No comment at this time.

SOW 1.4 BLOODSTAINS

THE METHOD TO BE DEVELOPED SHALL BE CAPABLE OF ANALYZING BLOODSTAINS FOUND ON A VARIETY OF COMMONLY FOUND SUBSTRATES, SUCH AS TEXTILES, GLASS, PLASTICS, CEMENT, PAINT, ETC.

Not Proven.

SOW 1.5 REAGENT CHARACTERISTICS

Not proven.

SOW 1.6 DISCRIMINATION PROBABILITY

THE ELECTROPHORETIC ANALYSIS SYSTEM DEVELOPED SHALL BE CAPABLE OF ACHIEVING A DEGREE OF DISCRIMINATION PROBABILITY OF 1 OUT OF 200 RANDOMLY SELECTED INDIVIDUALS, USING AS A SAMPLE A BLOODSTAIN AGED FOR FOUR (4) WEEKS.

Not Accomplished

1. The eight constituents selected for inclusion in the BAS will not discriminate 1 in 200 out of a general population. The authors have altered the SOW to fit their own needs by basing their claims on statistics for a white caucasian population.

2. No tests were ever made to prove that the eight constituents included in the BAS would provide the required degree of

accuracy or reliability in four-week-old stains.

SOW 1.7 ANALYSIS AMBIGUITY

THE CONTRACTOR SHALL REDUCE THE AMBIGUITY RESULTING FROM INTERPRETING ANALYSIS RESULTS SO THAT A SEROLOGIST TRAINED EXTENSIVELY IN THIS PROCEDURE FOR NO MORE THAN TWO (2) WEEKS CAN CLEARLY INTERPRET THOS RESULTS.

Not proven.

SOW 1.8 SIMULTANEOUS ANALYSIS

NO MORE THAN THREE (3) ELECTROPHORETIC SET-UPS SHALL BE NEEDED IN ORDER TO RUN ALL OF THE CHOSEN GENETIC MARKERS SIMULTANEOUSLY.

Not Accomplished.

I am the least likely person to defend the concept of "three setups". As early as August, 1977, I was officially urging that the narrow constraints of the technical requirements be put aside to permit development of the best possible system. However, since this requirement for "simultaneous analysis" was precisely the point of controversy between the University research laboratory and the corporate managers of this project, accurate and honest reporting of results is required of the Final Report.

The Beckman Final Report, in its discussion of the technical requirements for this project, should have included a definition of three "setups" as it appeared in the Statement of Work:*

"The number of required separations shall be accomplished on no more than 3 supporting media, each of which may be used only once for any single characterization."[12]

The Beckman Final Report should have clearly stated that this technical requirement (among others*) was not met. The BAS has four supporting media, and each one is of a differing composition. There is every indication that the so-called Group III set-up (using 2 supporting media) does not work.

1.9 ACCURACY OF ANALYSIS

THE REQUIREMENT FOR ACCURACY OR RELIABILITY OF DETECTION OF THE BLOOD CONSTITUENTS SELECTED BY THE CONTRACTOR SHALL BE NO LESS THAN ((PERCENT AT THE () PERCENT CONFIDENCE LEVEL. THIS REQUIREMENT SHALL BE DEMONSTRATED DURING THE CRIME LABORATORY DEMONSTRATION TESTS AND SHALL APPLY ONLY TO UNCONTAMINATED STAINS . . .

Not Accomplished.

Laboratory A had a 71% level of accuracy since only 6 of the 8 constituents were run on 4 of the 5 Blind Trial tests. Laboratory D had only an 82.5% level of accuracy for the five trials. It should be noted that this is not the fault of the readers. It was the accuracy and the reliability of the BAS which was being tested, not the skill of the analysts. The test results show that when there was something to read, they read it correctly. The number of "questioned" or "no activity" responses are relevant to the accuracy of the BAS, not to the skill of the crime lab technician.

1.10 COST

No comment at this time.

THE FEASIBILITY DEMONSTRATION TESTS PLAN AND FEASIBILITY TEST REPORT

The FDT Plan opens with the following statement: "Prior to presenting the Bloodstain Analysis system to selected crime laboratories for field trials, it must be demonstrated that the system satisfies the criteria of the Statement of Work. It is the objective of the Feasibility Tests to verify that these criteria have been met. For convenience, the criteria from the S.O.W. are listed here."[13]

It is apparent that the "criteria" listed are for the "convenience" of the individuals at Beckman who are seeking to justify this methodology. Certain rather significant changes have occurred in the criteria in transit from the S.O.W. to the pages of the FDT Plan.

1. First of all, the criterion requiring three setups is missing altogether.*

2. Even more important, the criterion specifying discrimination probability has been radically altered. In the S.O.W., this technical requirement reads as follows:

> "The electrophoretic analysis system developed shall be capable of achieving a degree of discrimination probability of one out of 200 randomly selected individuals, using as a sample a bloodstain aged for four (4) weeks."[14]

The underlined requirements are missing from the FDT Plan.

The words "randomly selected" are deleted because the eight constituents do not yield a discrimination capability of 1 in 200 in a general population. Elsewhere[15], the authors explain that they are basing their claims to a discrimination capability of 1 in 200 of statistical data for white caucasians.

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* In the S.O.W., three setups are described as "3 supporting media".[12] The BAS has four supporting media (see comments re. System Development.)

A random sample of, for instance, the California population would yield a significantly lower discrimination.

The words "using as a sample a bloodstain aged four (4) weeks" are deleted because the authors feared that they would be unable to make an acceptable number of correct determinations on stains of that age. Elsewhere the authors claim that all 8 variants have been phenotyped of 4 week old bloodstains. This claim is unsubstantiated.

It is possible to obtain the specified ~~determination~~ discrimination capability for the given (white) population using fresh blood. However, the authors should have been aware that there are fundamental difficulties concerning electrophoretic analysis of proteins and enzymes in aged blood or bloodstains.*

The manner in which the authors effect the change relative to the age of the test bloodstains is worthy of notice. First, all reference to age of stain is left out of the list of criteria (on page A-13). Next, in discussing the test samples (page A-14) this sentence appears: "Approximately 18 samples shall be presented for test after aging a maximum of four weeks" (page A-14). Finally, in the Feasibility Test Report itself, the following statement was made: "The age of the stain was not to exceed four weeks. ... The age ranged from two to four weeks with seven of the stains being four weeks old." (p. A-8) There is considerable difference between stains two weeks old and stains four weeks old, and it is a simple matter to keep track of the age of test stains; however, the report does not give the reader any further information concerning the ages of the coded stains.

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* This subject is discussed at considerable length by Grunbaum in the FINAL REPORT ON SUBCONTRACT Z-8478905-G BETWEEN BECKMAN INSTRUMENTS, INC. AND THE UNIVERSITY OF CALIFORNIA, "TECHNICAL SUPPORT FOR ELECTROPHORETIC BLOODSTAIN ANALYSIS PROGRAM, December 15, 1977, pp. 16, 18-21.

The Feasibility Demonstration Tests and the FDT Report should be unacceptable to LEAA for the following reasons:

1. It is contrived to eliminate the possibility of failure, i.e., ignoring requirements for three supporting media and discrimination capability of 1 in 200 of 4 week old stains.

2. The referee laboratory is not named. The referee analyses for the coded samples are not given. Was there a referee laboratory?

3. No protocol was established or maintained to insure impartial monitoring.

Obviously the Aerospace Program Manager was willing to certify the contrived and misleading FDT Plan; obviously he also approved the Feasibility Test Report which claims such glowing success. Both documents help to justify his partisan support of a particular direction of research that was counter to the recommendations of the subcontracting University of California research laboratory.

CRIME LABORATORY TEST REPORT

The Crime Laboratory Test Plan is not included in the Final Report. This is a very grave omission, both for Beckman ATO and The Aerospace Corporation. Preparation of this Plan was a major contractor task and requirements for its content are spelled out in detail.[16] ~~(See Attachment B.)~~. This Plan was to be submitted to The Aerospace Corporation for approval 30 days prior to the beginning of the Crime Laboratory testing. WAS THE PLAN EVER MADE AND APPROVED?

The portion of the Program Plan delineating the objectives and contents of this required Plan are not attached ~~(I.P.~~ (see 16) This attachment must be read in order to understand what the Crime Laboratory Tests should have been, and how they failed in these stated objectives.

The objective of these tests was to "demonstrate the capability for straightforward transfer of the electrophoresis technology from the development laboratory to a working environment."[17] The tests should have shown "that the techniques can be effectively implemented by personnel of suitable skill levels and that the technology is of practical value in a functional setting."[18] Objective evidence should have been generated through this testing, so that there would have been little need for subjective interpretation of results.

The only "objective" evidence in the CLDT Report is the table[19] ~~(see Attachment M)~~ reporting on the ability of the crime lab participants to identify the test blood stains. Unfortunately, two of the four laboratories were unable to meet the specified level of accuracy.*

---

* "The requirement for accuracy or reliability of detection of the blood constituents selected by the contractor shall be no less than 99 percent at the 90 percent confidence level. This requirement shall be demonstrated during the crime laboratory demonstration tests ..." Statement of Work, Paragraph 1.9, p. 8.

At this point, accuracy in reading results should not have been the overriding issue. Supposedly, the accuracy and "readability" of the methodology would have been established in the research laboratory and during the Feasibility Demonstration Tests. Other criteria should have been tested to determine the capability for transfer of this methodology to the working crime laboratory.

It is possible for individuals in the developmental laboratory to have particular expertise and experience and to have developed "workarounds" to system level problems. Crime Laboratory tests must show that technicians with the level of training specified in the S.O.W. can, in a working environment, use the entire system on bloodstains with ease and accuracy, within the hands-on and run times allotted, and on a variety of substrates. The Report contains no data to substantiate that any such test measurements were made.

Although "objective" evidence is scanty (one table of blind trial readings)[19] it does suggest that the BAS may not be transferable to the crime laboratory. We note that laboratory A was unable to run Group III on four of the five trials "because of excessive casework". We also note, in a discussion of results, that "due to excessive casework, laboratory A is routinely testing for only Groups I and II." (We have "unofficial" confirmation that a second of the laboratories has now also rejected Group III for routine casework.)

The table shows that in the first test, Laboratory A scored only 66% correct readings. In subsequent tests, after Group III was dropped, the correct readings went to 86% for Trial 2 to 100% for trials 3-5. It might be inferred that the "excessive casework" was a lucky break as far as the blind trials were concerned.

The table should be rejected for what it does not say. The age of each stain in each test should be given. This is especially important in regard to errors, questioned readings, and no activity.

It is also essential to know which phenotypes were questioned or showed no activity.

Both laboratory A and laboratory D did not meet the specified level of accuracy. The explanation[20] for laboratory D's difficulty is "some stains were very old, which would account for the high number of questioned and no activity results." Again, "excessive casework" is blamed. Why is the reader not permitted to know the exact age of the stains, and the particular variables involved? This information is extremely useful in evaluating the stability of the constituents chosen for inclusion in the BAS.

The fault is not with the test laboratories but with the contractor who should have planned and managed the Crime Laboratory Demonstration Tests in a manner that would have adjusted to the case work of the participating laboratories.

Other serious omissions in the CLDT Report are as follows:

1. The SOW specifies a certain degree of training and experience for laboratory personnel which will enable them to learn the new methodology with 2 weeks of training. What was the educational background and experience of the crime lab personnel who participated in these tests?
2. Specifically, what was their previous experience with electrophoretic analysis of dried bloodstains?

It would be of extreme value to know the degree to which the crime laboratory participants were familiar with other electrophoretic methodology. The case histories reveal that Laboratory 2, prior to the training sessions, was typing for EsD, PGM, and EAP; laboratory 3 was grouping for the ABO system and typing the PGM system. We have no clue as to the experience of the other participating serologists -- presumably they were equally limited. For technicians who know very little electrophoretic methodology, any training in any methodology will greatly increase their capabilities. They will quite sensibly accept free

equipment and free training and take pride in their newly-acquired skills. They are most certainly in no position to make judgments as to the relative merits of "old" vs. "new" methodologies, or the BAS vs. alternate methodologies.

3. What was the size of the participating laboratories? And especially ~~And especially~~ its forensic serology group?

   (The SOW recommends a spectrum of forensic laboratories ranging in size from large to small.[21] It is the smaller laboratories that most need a simplified, easy-to-learn, rapid and reliable methodology.)

4. How were the stains handled? How did they get from the research laboratory to the crime laboratories and how were they stored?

5. Why is there no objective measurement of hands-on time, run time, etc.

6. Why is there no evaluation by the crime laboratories of ease of performance, possible difficulties, etc. (Possibly a check list on a sliding scale for each process in each methodology.)

7. Why is no mention made of how the electrophoretic results were recorded for future examination? Obviously, with gel media, this must be done by photography. Were all of the crime lab blind trial electrophoretic runs photographed? If not, why not? Is this not an essential step in the preservation of evidentiary material? Is the time for photographing and developing pictures figured into the "run time"? If photography had been done, other laboratories could have learned something.

The actual case histories[22] cited raise more questions than they answer.

1. Laboratories 2, 3, and 4 have access to blood from live victims and live suspects. Why then are they testing blood 12 weeks old or 6 weeks old or of unknown age from these individuals?

2. How do the authors verify the accuracy of casework results?

3. What were the objective measurements for analyses of bloodstains on materials other than cloth? What is meant by the Statement "No problems were encountered that could specifically be attributed to the material containing the bloodstains."?[23] Was the possibility tested in any scientific way?

1. The Aerospace Corp., STATEMENT OF WORK FOR A BLOODSTAIN ANALYSIS SYSTEM, Contract No. J-LEAA-025-73, May 26, 1976. P. 21.

2. Beckman Instruments, Inc., FINAL REPORT-BLOODSTAIN ANALYSIS SYSTEM, Subcontract No. 67854, July, 1978. FR-27X-101

3. Subcontract No. Z 847905-G , UC/Beckman.

4. Beckman Instruments, ELECTROPHORETIC BLOODSTAIN ANALYSIS PROJECT-PROGRAM PLAN, Subcontract No. W-67854, Feb. 11, 1977. PP. 7, 8, 9.

5. UC/Beckman Subcontract No. Z 847905-G, Page 2 of 4.

6. Op cit. Beckman FINAL REPORT, p. v.

7. Op cit. U/C Beckman Subcontract No. Z-847905-G, Attachment A, Statement of Work, p. 7.

8. Beckman MONTHLY PROGRESS REPORT to the Aerospace Corporation, August 8, 1977, p.3.

9. Op cit. Beckman FINAL REPORT, p. 4-20.

10. Ibid. p. 6-1.

11. The Aerospace Corporation, STATEMENT OF WORK FOR A BLOODSTAIN ANALYSIS SYSTEM, Prepared for NILECJ UNDER Contract No. J-LEAA-025-73. "Annex C-Technical Requirements" pp. 21-23.

12. Op cit. UC/Beckman Subcontract Z-847005-G, Attachment A, Statement of Work, p. 2.

13. Op cit. Beckman FINAL REPORT, p. A-13.

14. Op cit. The Aerospace Corporation, STATEMENT OF WORK FOR A BLOODSTAIN ANALYSIS STYSTEM, P. 23.

15. Op cit. Beckman FINAL REPORT,pp 2-3, 5-1.

16. Op cit. Beckman Program Plan, Feb. 11, 1977, P.29-30.

17. Ibid. p. 29

18. Ibid. p. 30

19. Beckman FINAL REPORT, p. B-9.

20. Ibid. p. B-7.

21. Beckman PROGRAM PLAN, Feb. 11, 1978, p. 30

22. Op cit. Beckman FINAL REPORT, pp B-8, B-10 to B-12.

23. Ibid. B-8.

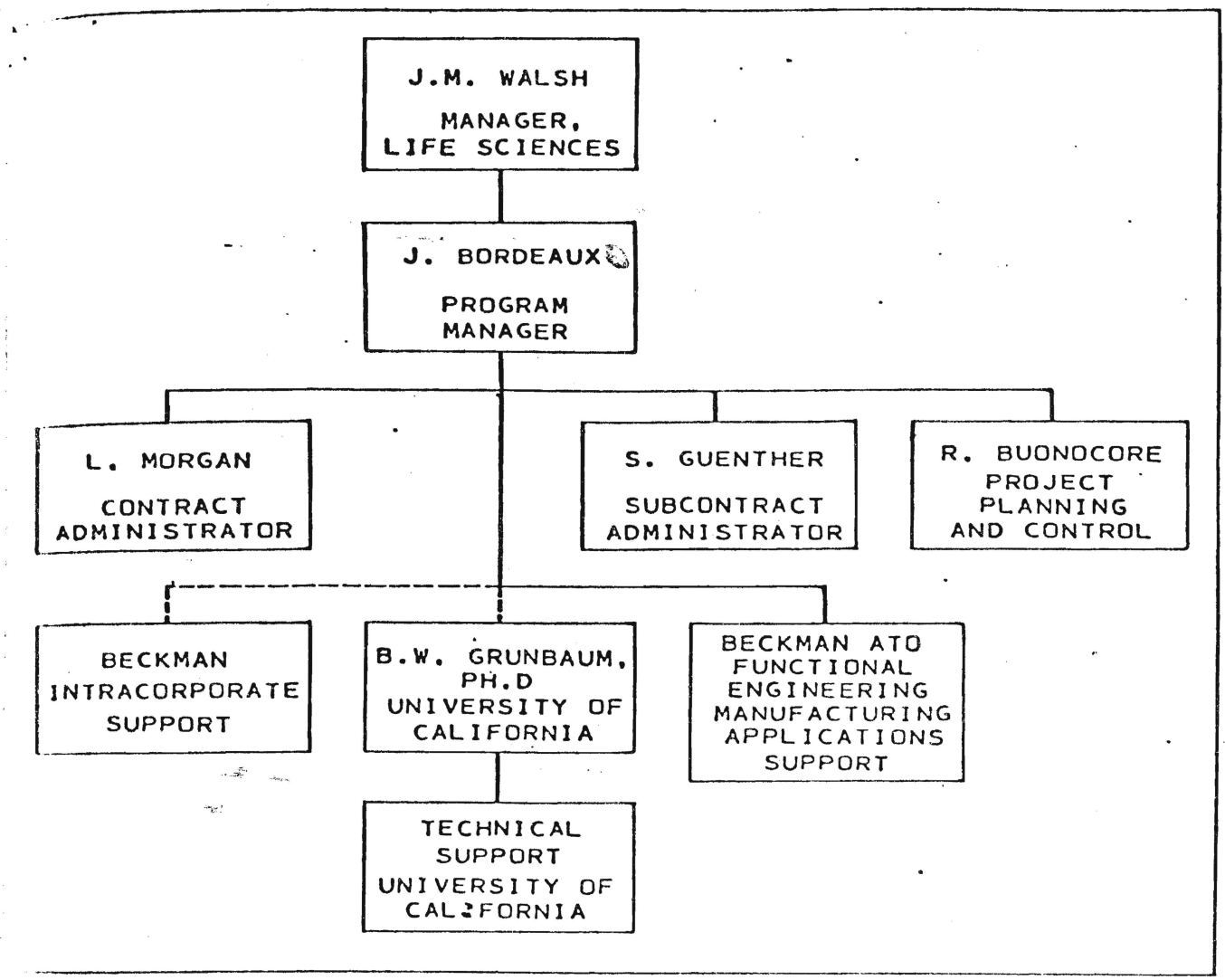

Figure 1. Organization Chart--Bloodstain Analysis Program

From: ELECTROPHORETIC BLOODSTAIN ANALYSIS PROGRAM
PROGRAM PLAN
Subcontract No. W-67854
Beckman Project 1361-2700-800
Dated: February 11, 1977
Submitted by Beckman Instruments, Inc., Advanced Technology Operations, to The Aerospace Corporation, Washington, D.C. 20024.

redirection of effort will occur only with the approval of the Program Manager. Key program personnel are described in the following paragraphs.

3.2.1 John M. Walsh, MS, MBA--Manager of Life Sciences

Mr. Walsh is responsible for all business activities associated with Life Sciences. Mr. Walsh's qualifications derive from his academic background in both technical and business disciplines and from a history of line management positions. He has successfully performed as Program Manager on hardware development programs and studies, specializing in chemical measurements and advanced concepts for the performing medical measurements. These efforts have been undertaken for Beckman, various branches of the armed services, NASA centers, and industrial firms.

3.2.2 Jean Bordeaux, B.E., CH.E., MS.A.E.--Program Manager

Mr. Bordeaux is primarily concerned with establishing project organizations, providing program direction, and monitoring progress from both a technical and business standpoint to ensure that program goals are met. Mr. Bordeaux reports functionally to Mr. Walsh. Mr. Bordeaux has successfully managed projects several times greater in magnitude than the proposed program and is well qualified through training and experience to act as the Program Manager in the proposed effort.

3.2.3 Benjamin W. Grunbaum, Ph.D--Master Criminalist

Dr. Grunbaum is currently a research biochemist at the White Mountain Research Station, University of California, Berkeley. Dr. Grunbaum was a visiting Professor of Forensic Medicine at Hadassah Medical School, Hebrew University, Jerusalem, in 1971-72. Following that, he was a consultant in forensic medicine and clinical methodology to the World Health Organization.

It is Beckman's opinion that Dr. Grunbaum is one of the world's leading experts in the technology of electrophoresis and especially the application of this technology to the solution of problems in the forensic sciences. Dr. Grunbaum has published widely in the application of electrophoretic technology

to the analysis of bloodstains. Beckman plans to subcontract with the University of California, Berkeley, so that Dr. Grunbaum's talents can be applied in satisfying the objectives of the proposed program.

3.2.4 Brian G. D. Wraxall

Mr. Wraxall will join the research team from the Metropolitan Police Laboratory, London, England, from which he has been granted leave-of-absence to participate in this program. The work of the Metropolitan Police Laboratory is well known, especially in the area of the electrophoretic analysis of bloodstains. Mr. Wraxall will bring to the program an expertise in starch gel technique which will compliment the experience at the University of California, Berkeley.

3.2.5 Mark Stolorow

Mr. Stolorow is currently associated with the Michigan State Police Department and is experienced in electrophoretic bloodstain analyses. He will bring to the group the experience and viewpoint of a working American criminalist. He also has been granted leave-of-absence to participate in the program.

4.0 SUBCONTRACTOR

Subcontract Z847905-G, has been issued to the University of California, Berkeley, and consulting subcontracts for the services of Mr. Stolorow and Mr. Wraxall have also been approved. The university subcontract will be managed by Mr. Walsh generally in accordance with the Beckman Subcontract Management System. Dr. Grunbaum will manage the work performed at the White Mountain Research Station including the technical efforts of the consultants.

The university will submit monthly cost and man-hours reports for Beckman management surveillance and tracking.

(D-1)

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1630 SO. STATE COLLEGE BLVD., ANAHEIM, CALIFORNIA 92806 • TELEPHONE: (714) 634-4343 • TWX: 910-592-1260 • TELEX: 06-78413

August 10, 1977

Mr. Brian G. D. Wraxall
University of California, Berkeley
White Mountain Research Station
Building T-2251
Berkeley, California 94720

Dear Mr. Wraxall:

The purpose of this letter is to clarify the relationship of you, as a consultant of Beckman Instruments, Inc., to the personnel, facilities and functions of the White Mountain Research Station (WMRS) of the University of California, Berkeley. Key areas in this relationship are as follows:

1. Beckman Instruments, Inc., has issued a subcontract to the University of California for the performance of certain tasks related to the development of a system for dry bloodstain analysis. Benjamin W. Grunbaum, Ph.D. is responsible to the University for the performance of the Statement of Work of that subcontract. Your consulting agreement with Beckman states that you shall be located at the University of California, Berkeley, to work on this program under the technical direction of Dr. Grunbaum. Dr. Grunbaum must be kept completely informed about the direction and results of your investigations conducted on the Bloodstain Analysis Program in order for him to fulfill his responsibilities to the University and to Beckman.

2. Your efforts under the consulting agreement with Beckman are restricted to the Bloodstain Analysis Program. You should not be involved in other activities being conducted at the WMRS.

3. All data, experimental results, etc., resulting from your efforts on the Bloodstain Analysis Program must be released through Dr. Grunbaum to Beckman prior to disclosure to others, including The Aerospace Corporation. Any queries regarding the Program directed to you by others should be referred to Beckman for reply. Although Dr. Grunbaum's or Beckman's interpretation of your data may differ from your own because of programmatic considerations, you retain the privilege of registering and documenting dissenting opinion.

B+2

4. All data, experimental results, etc., resulting from your efforts on the Bloodstain Analysis Program must be freely available at all times to Dr. Grunbaum and/or the Beckman Program Manager.

5. Involvement in activities related to forensic analysis but unrelated to the specific requirements of the Bloodstain Analysis Program should be undertaken only with the specific approval of the Beckman Program Manager. If such activities require the use of the facilities, equipment or personnel of the WMRS, the specific approval of Dr. Grunbaum is also required. Dr. Grunbaum shall be kept completely informed about such activities.

6. Your active participation in planning the investigations required for the Bloodstain Analysis Program is expected and encouraged. Final decisions about specific directions are the responsibility of the Beckman Program Manager.

We are pleased with your excellent technical performance under our consulting agreement to date. I trust this letter adequately clarifies those areas about which some confusion seems to have existed in the past. If you have any questions, please do not hesitate to contact me.

Very truly yours,

John M. Walsh

John M. Walsh, Manager
Life Sciences

JMW:bv
cc: J. Bordeaux
B. Grunbaum, Ph.D.
R. Shaler, Ph.D.
S. Derda

13 October 1977

TO: Campus Research Office
M-11 Wheeler Hall

I am writing to request that you make arrangements for the immediate termination of subcontract Z-84705-G in which Beckman Instruments, Inc. is named as Buyer, the University of California as Seller, and I am key investigator.

After careful consideration and much effort to re-establish a basic understanding with Advanced Technology Operations (ATO) of Beckman Instruments, I am forced to the conclusion that it would be unprofessional for me to continue with a project that I have reluctantly come to regard as a boondoggle.

In good faith, I joined with the ATO of the Beckman Company as a partner in the research and development required to design a new and efficient "Bloodstain Analysis System" for use in this country's crime laboratories. Arbitrary decisions made by Beckman ATO seem designed to change this University research laboratory into a service laboratory operating at Beckman's convenience. I am not permitted to be part of the decision-making process and I am told by Beckman that, according to the terms of the subcontract, it is my responsibility to support a technological development which I consider a cynical waste of time and public money. If Beckman's interpretation of the subcontract is correct, I will now be obliged to support, promote, and help introduce into U.S. crime laboratories a system of methods which I am convinced will not work under practical field conditions. I do not want to lend my name or professional reputation to this effort. I believe it is against the best interests of the University for this laboratory to be exploited in this way.

It is necessary to review briefly the circumstances that led me to believe that when I agreed to this subcontract that I was retaining the right to guide research and make policy decisions in an area in which I am expert.

For several years the Aerospace Corporation, sponsored by the Law Enforcement Assistance Administration of the Department of Justice, has been concerned with the development of a Bloodstain Analysis System for use in U.S. crime laboratories. In September, 1973, I was invited to serve as a consultant to this project, but declined because I felt that "I would not have a direct responsibility in both long range and day-to-day planning, supervision, and evaluation in research" for which I have a deep professional interest.*

Three years later, I was invited by The Aerospace Corporation to submit a program plan, a technical and a cost proposal and a "Statement of Work" for a Bloodstain Analysis System". Again I declined, stating in my reply that I preferred to assist The Beckman Instruments Inc. ATO to prepare a proposal in which I would be subcontractor. (See attached letter, 29 July 1976).

The Beckman Company won the contract with the stipulation that I must be key investigator in a subcontract with the University of California.

I entered into this arrangement in good faith, though I was rather amazed to see the administrative superstructure set up by Beckman and Aerospace to "guide" this project. I realize now that if a grant had been made directly to the University of California, the work would have been done properly for considerably less cost to the Federal Government.

The work began in January of this year and progressed with highly satisfactory laboratory results, as I had supposed it would. Understanding

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* Documentation available.

(C-3)

and community of purpose was promoted in large measure through the efforts of Mr. G. Roberts and Mr. R. Kennel of the Aerospace Corporation. In june, the whole character of the contractual relationship soured, perhaps only coincidently when the Aerospace Corporation suddenly and inexplicably changed management of this project and a person new to the Aerospace Corporation took over.

In letters and interim reports from me to Beckman ATO I reported my findings and recommendations in keeping with my professional obligations. My comments have been largely ignored, and my recommendations have been over-ruled.

The Project is now on a course that is, in my opinion, totally wasteful of time and money. The system that will finally emerge will not meet the needs of crime laboratories and will not be adapted by them. It will not be beneficial to either the University or myself to be associated with this development.

If this subcontract is not cancelled, this laboratory will be expected to provide laboratory space for an unspecified length of time for a Beckman or an Aerospace consultant who will do developmental work free of University supervision. This laboratory will be expected to engage in testing and teaching to criminalists a dubious technology which is contrary to the actual rationale which initially prompted this research.

Benjamin W. Grunbaum

WHRS

(D-1)

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March 6, 1978
CM 2700-UCB-10

University of California
White Mountain Research Station
Building T-2251
Berkeley, CA 94720

Attention: Dr. B. W. Grunbaum
Research Chemist

Subject: Bloodstain Analysis Project
Subcontract Z-847905-G

Dear Dr. Grunbaum:

This is in reply to your letter of 8 February 1978, requesting copies of the October monthly progress report clarficiation and the revised minutes for the October 3 program review meeting. Copies of those documents are enclosed.

A later paragraph of your letter included four assertions, two of which deserve comment.

Item 2. Beckman understands the system of sequential analysis proposed. Your system recommendation will be included in our final report as a dissenting opinion.

Item 4. Your assertion that system selection was not based on test results is not accurate and is totally unacceptable. Beckman's decision regarding the final direction of system development was made solely on tests results which showed conclusively that to meet the goals of the Statement of Work within the contract budget it was mandatory that we proceed with the most promising system.

there WERE "TEST RESULTS" there are Not?

Tests results for group analysis using the selected starch gel system were impressive and well documented by both the Beckman consultants and University personnel, however no data has been made available to us supporting group analyses using the CAM system.

We will continue to invite your comments on appropriate portions of any subsequent reports.

Sincerely,

J. L. Morgan
Senior Contract Administrator

JLM:gw

cc: Campus Research Office
J. Meltzer, Aerospace Corp.
R. Shaler, Aerospace Corp.
J. O. Sullivan, LEAA

BECKMAN

BECKMAN INSTRUMENTS, INC.
ADVANCED TECHNOLOGY OPERATIONS
1630 South State College Boulevard, Anaheim, California 92806 · Telephone: (714) 634-4343 · TWX: 910-592-1260 · Telex: 06-78413

November 18, 1977
CM 2700-28

The Aerospace Corporation
Suite 4040
955 L'Enfant Plaza, S. W.
Washington, D.C. 20024

Attention: Susan Derda
Subcontract Administration

Subject: Clarification of Monthly Progress Report
Bloodstain Analysis Program

Dear Ms. Derda:

Our monthly Progress Report for October, 1977, stated that the decision to relocate the laboratory facilities to Beckman resulted from the decision to concentrate development effort on the gel plate methodology. Dr. B. W. Grunbaum, Principal Investigator for the program at the University of California, has suggested a change to that portion of the report.

Dr. Grunbaum has asked us to re-emphasize his position that the requirements of the contract Statement of Work are invalid and that a system satisfying these requirements will not prove useful or be acceptable to crime laboratories.

The analytical system offering the greatest potential for satisfying the letter of the Statement of Work does not employ methodologies developed or espoused by Dr. Grunbaum. Because the Aerospace Corporation did not waive the contractual performance requirements, Dr. Grunbaum elected not to continue participation in the program and formally requested termination of the subcontract on October 13, 1977.

Susan Derda
The Aerospace Corporation
Suite 4040
955 L'Enfant Plaza, S. W.
Washington, DC 20024

To accede to this request appeared to be in the best interest of the program. With the approval of the Aerospace Corporation, Beckman released the University from its subcontract obligation by negotiating a reduction in subcontract scope and transferring the laboratory facility to Anaheim.

A copy of Dr. Grunbaum's suggested change to the Monthly Progress Report is attached as dictated.

Sincerely,

(signed by J.L. Morgan)

J. L. Morgan
Senior Contract Admin.

JLM/vb

cc: Dr. Robert Shaler (1)
Program Manager

Mr. John McCombs (3)
University of California

Dictated Over Phone by Dr. B. W. Grunbaum

November 16, 1977

The following replaces the third paragraph, page 1, of October Monthly Progress Report, Bloodstain Analysis System:

The decision to concentrate effort in this direction was counter to the findings and recommendations of Dr. B. W. Grunbaum, Principal Investigator of the technical support for the Blood Analysis System Project at the University of California. Dr. Grunbaum concluded that it would be unprofessional of him to continue support of a development which he feels will not meet the needs of the U.S. Crime Lab and will not be accepted by them. Accordingly, on October 13, 1977, Dr. Grunbaum asked the Campus Research Office of the University of California to request termination of the subcontract with Beckman. Beckman complied, and on November 11, 1977, the work under UCB cognizance will terminate. Arrangements are now being made to transfer the necessary personnel and hardware to the Beckman facility in Anaheim.

Dr. Grunbaum requested that the "corrected" report be sent to Aerospace as soon as possible and a copy forwarded to him.

Dolly Monroe

REVISED PROGRAM REVIEW MEETING
ELECTROPHORETIC BLOODSTAIN ANALYSIS
BECKMAN/UNIVERSITY OF CALIFORNIA
3 OCTOBER 1977

Attendees

Aerospace	Beckman	University of California
G. Denault	J. Bordeaux	B. Grunbaum
S. Derda	L. Morgan	
Q. Kwan	J. Walsh	
R. Shaler	B. Wraxall	

PROGRAM REVIEW AND STATUS

The System Development portion of the overall program began an scheduled on 1 September 1977. Based on the work performed during the System Definition phase and the Statement of Work requirements calling for no more than three (3) electrophoretic set-ups, the major thrust of the System Development effort will be the intensive further development of the starch/agarose substrate. This substrate was selected as it shows applicability to the largest number of selected constituents and also shows good potential for multisystem analysis. → To only 3 out of 8 constituents 3 are on starch alone 1 on acrylamide 1 on agarose alone

SYSTEM DEVELOPMENT

1. Confirmation Tests

   A series of tests have been conducted which confirm the results obtained in the Blind Trials conducted during System Definition. These tests were performed using systems and methodologies developed during System Definition.

2. Serial Separation

   Selected constituents have been grouped for further development and preliminary results are as follows:

   - Group I - PGM, EsD, GLO1: high degree of confidence for use as a practical system
   - Group II - EAP, AK, ADA: EAP and AK are acceptable now with a good probability of including ADA

TABLE VIII. BLIND TRIAL — PGM — DETECTABILITY OF DRIED STAINS

Size of Stained Thread (cm)	Stain Age (Days)	Substrate	No. of Stains	No. of Readers	Total Readings	Correct	In-correct	Ques-tioned	No Activity	No. of Variants
4 x 0.5 ≅ 0.7 µl WB	24	CAM	2	4	8	6	-	1	1	1
		Starch	2	3	6	5	-	1	-	1
	31	CAM	2	4	8	8	-	-	-	2
		Starch	2	3	6	5	-	1	-	2
	42	CAM	3	4	12	11	-	1	-	3
		Starch	3	3	9	8	-	1	-	3
3 x 0.5 ≅ 0.5 µl WB	24	CAM	2	4	8	7	-	1	-	1
		Starch	2	3	6	6	-	-	-	1
	31	CAM	2	4	8	8	-	-	-	2
		Starch	2	3	6	6	-	-	-	2
	42	CAM	3	4	12	12	-	-	-	3
		Starch	3	3	9	9	-	-	-	3
2 x 0.5 ≅ 0.35 µl WB	24	CAM	2	4	8	3	2	3	-	1
		Starch	No Test							
	31	CAM	2	4	8	5	-	3	-	2
		Starch	No Test							
	42	CAM	3	4	12	11	-	1	-	3
		Starch	No Test							
1 x 0.5 ≅ 0.18 µl WB	24	CAM	2	3	6	4	2	-	-	1
		Starch	No Test							
	31	CAM	2	3	6	5	-	1	-	2
		Starch	No Test							
	42	CAM	3	4	12	9	-	3	-	3
		Starch	No Test							

and this will set the direction for the development of procedures for simultaneous analyses. It may be that compromises will be made where it is necessary to analyze for one system on a substrate which did not show up best on the blind trials. This will all be done in consonance with the objective of providing unambiguous discrimination with the simplest system.

Hardware Status

It was determined that there are not really two independent Nanophore systems. Rather, there are two cells with common supporting equipment. However, the hardware has been received back in the laboratory and is now available to support our tests. Although certain desirable changes have been identified which might make it easier for an inexperienced person to get the best results with the Nanophore prototype, it is believed that the existing hardware can be tested as is and yield valid results.

Problem Areas

While we have the usual problems which are incident to any development effort, we have an additional one which has consumed so much time that it should be specifically pointed out as a problem area. This is with the troubleshooting of the PGM procedure. For approximately six weeks, work has been going on to obtain satisfactory results with the PGM procedures on both starch and cellulose acetate. Historically, problems with PGM have been traced to the inactivity or to a decrease of activity in the G6PD. In this case the source for the G6PD was contacted. This is Sigma Chemicals and an assay on the lot we use was requested. The assay indicated the activity to be normal. However, fresh material was received and tested. At first it appeared that that was indeed the trouble as satisfactory results were obtained. However, immediately on retesting again a lack of activity showed up. Other sources of G6PD were also contacted and samples obtained and trials made. Again, results have been variable. The storage containers for the chemicals have been examined, the distilled water that was used was checked; nothing has been identified as being a positive source of the problem. This has been most disconcerting in that it has taken a considerable amount of laboratory personnel's time and has caused

significant interference in conducting our blind trials. Generally this type problem yields itself to a methodical attack on an ingredient basis to termine the source of the problem and once it's found it can be corrected. this case, the variable results have continued to obscure the basic cause the difficulty.

rk Planned for July

ie major effort will be in finishing the development work on GLO 1 and Gc and ompleting the blind trials. The troubleshooting on PGM hopefully will be over ortly. While the blind trials for the other systems can proceed, it is lanned to run them all as close together as possible on the same stain. herefore, it is desirable to get PGM working as soon as possible.

This table shows "official" results of 2nd series of blind trials July 1977 (G)

Table 1. Blind Trials

Systems Tested: EAP: ESD: PGM:

Number of Trials Each System:

	Starch Gel	CAM
EAP	2	2
ESD	2	3
PGM	1	1

System EAP

1.	Age of Stains	4 Wks.	4 Wks.
2.	Number of Stains	15	31
3.	Number of Readers	4	4
4.	Total Number of Readings	64	109
5.	Number Correct	64	106
6.	Number Incorrect*	0	3
7.	Number Questioned	0	3
8.	Variants Present	2	2

*One Reader E. Wraxall **

System ESD

1.	Age of Stains	4 Wks.	4 Wks.
2.	Number of Stains	16	15
3.	Number of Readers	3	5
4.	Total Number of Readings	48	75
5.	Number Correct	48	75
6.	Number Incorrect	0	0
7.	Number Questioned	0	2
8.	Variants Present	2	2

System PGM

1.	Age of Stains	4 Wks.	4 Wks.
2.	Number of Stains	16	15
3.	Number of Readers	4	(6)
4.	Total Number of Readings	64	80
5.	Number Correct	64	79
6.	Number Incorrect	0	1
7.	Number Questioned	1	5
8.	Variants Present	3	2

** see paper by Zajac & Grunbaum, in which Wraxall failed to correctly identify the phenotypes of EAP in a starch-gel plate he himself prepared. JFS 23(3) 615-618, 1978

This table shows (F.R.) results in July 1978

TABLE IX. BLIND TRIAL SERIES 2

Test and Substrate	Stain Age	No. of Stains	No. of Readings	Total Readings	Correct	Incorrect	Questioned	No Activity	No. of Variants
EAP (Starch)	2-4 wks	10	4	40	40	-	-	-	2
EAP (CAM)*	No Test								
EAP (Starch)	4 wks	16 15	4	64	64	-	-	-	2
EAP (CAM)	4 wks	16	4	64	61	-	3	-	2
EAP (Starch)*	No Test	31		109	106	3			
EAP (CAM)	4 wks	15	3	45	45	-	-	-	2
EsD (Starch)	2-4 wks	10	4	40	37	-	3	-	2
EsD (CAM)	2-4 wks	10 (Test run twice; result unreadable)							
EsD (Starch)	4 wks	16	3	48	48	-	-	-	2
EsD (CAM)	4 wks	16	3	48	18	-	14	16	2
EsD (CAM)	4 wks	15	5	75	73 75	-	2	-	2
PGM (Starch)	4 wks	16	4	64	63 64	-	1	-	3
PGM (CAM)	4 wks	15	5 6	75 80	70 79	- 1	5	-	2

- these 2 tests were combined in original table PR-2700-7

* Why put in tests not performed?

T) Table I Results of Confirmation Tests

TABLE I. RESULTS OF CONFIRMATION TESTS

Constituent	Number of Stains Analyzed	Number of Variants	Number of Readers/Readings	Number Questioned Cam	Number Questioned Starch	Number Correct Cam	Number Correct Starch	Number Incorrect Cam	Number Incorrect Starch
EsD(1)	7	3	4-28 CAM 4-27 Starch	1	0	28	24	0	3
PGM(1)	7	3	4-28	1	0	28	28	0	0
EAP	7	5	4-28	2	0	28	28	0	0
AK	7	1	4-28	0	0	28	28	0	0
ADA	7	2	4-28	1	0	27	28	1	0
GLO I(1)	7	2	4-25		3		24		1
Gc(2)	7	3	1-4 4-27 Agarose	0	3 (Agarose)	4	24	0	3
Hp	7	3	4-20 (Step Grad.) 4-22 (Cont. Grad.)	3 (Step Grad.)	2 (Cont. Grad.)	19	22	1	0
				8	8			2	7

NOTES: (1) EsD, PGM, GLO I run simultaneously on starch gel.

(2) Run twice on CAM. Only one reader present for retest.

ability to meet specified increased analysis speed requirements, to provide analysis results with required reliability and accuracy, and to provide the required analysis results from specified minimum stain volumes, and the capability to meet the stated cost constraints are relatively objective in nature and there should be little difficulty in reaching an agreement on whether or not the system has met these design objectives. It is anticipated that these tests will be witnessed by The Aerospace Corporation and by Beckman Quality Assurance personnel.

10.4.3 Feasibility Demonstration Test Report (SOW 5.4.3)

Following the completion of the Feasibility Demonstration Tests, the results will be compiled in a Feasibility Demonstration Test Report. This report will include test rationale, methodologies employed, diagrams of equipment arrangements, and a summary of test results including discrepancies, if any. The data presented in this test report will be certified by Beckman Quality Assurance personnel and the witnessing representatives of The Aerospace Corporation.

10.5 Crime Laboratory Demonstration Testing (SOW 5.5)

10.5.1 Crime Laboratory Demonstration Test Plan (SOW 5.5.1)

Verification that the methodologies, reagents, and equipment meet program design goals will have been certified during the Feasibility Demonstration Tests. However, successful completion of these tests will serve only as an indication of design suitability. This is because the tests will be conducted by the scientists and engineers responsible for system development who can be expected to be intimately aware of system idiosyncrasies and who have developed, consciously or unconsciously, "workarounds" to system level problems. It is anticipated that the average criminalist has neither the time nor the motivation to develp these same "workarounds." The Crime Laboratory Testing, therefore, should demonstrate the capability for straightforward transfer of the electrophoresis technology from the development laboratory to a working environment. The tests should show that the techniques can be effectively

implemented by personnel of suitable skill levels and that the technology is of practical utility in a functional setting. The plan derived as a precursor to this evaluation is of extreme importance because the test program to be followed must present data capable of unequivocal interpretation, i.e., there must be objective evidence that the system meets important design criteria. The test program should be designed so that there is little need for subjective interpretation of results.

A test plan to accomplish this objective demonstration of system suitability will be developed jointly by Beckman and Dr. Grunbaum. The primary objective of the plan will be to outline a series of tests that will demonstrate that the system can be effectively employed with personnel of suitable skill levels and with no more than two weeks of intensive training. The plan will detail the training plan to be employed, the number and types of tests to be conducted, the methodologies to be employed, provisions for communication with participating laboratories for the collection of data, and the methods by which the test result will be interpreted. It is anticipated that the cooperation of the LEAA and The Aerospace Corporation may be elicited in the selection of a suitable spectrum of forensic laboratories for the conduct of these tests. It appears desirable to evaluate the approach in a number of laboratories, ranging in size from large to small, to ensure that representative sampling is obtained. However, the practical realities of the workload in small laboratories may preclude utilization of such laboratories in the tests because it may not be possible to spare laboratory personnel for the training program and subsequent evaluations.

The test plan will be submitted to Aerospace Corporation 30 days in advance of the tests to ensure that adequate time for review is available.

10.5.2 Crime Laboratory Demonstration Tests (SOW 5.5.2)

It is anticipated that the training program to be conducted prior to the Crime Laboratory Demonstration Tests will show that the design objectives for the system have been met, i.e., that personnel of suitable skill levels can obtain reliable results after proper training. It is probable that the final stages