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**ARIZONA**®  
TUCSON ARIZONA

Vice President for Research  
and Graduate Studies

Administration 601  
Tucson, Arizona 85721  
(520) 621-3512  
FAX (520) 621-7507

29 June, 1995

Mary Mace, Grants Officer  
Technical Acquisition Branch 1  
Division of Contracts  
Office Administration  
United States Nuclear Regulatory Commission  
Washington, D.C. 20555-0601

RE: Notice of Termination to Mr. Wheeler, dated 23 May, 1995

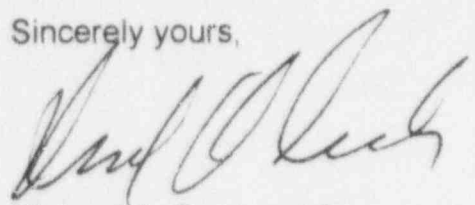
SUBJ: Notice of Termination of grant # NRC-04-93-089

Dear Ms. Mace:

The University of Arizona wishes to appeal the notice of termination issued by your office dated 23 May 1995. The grounds for the appeal are as described in the attached documents (pp.7) and attachments supplied by Dr. John Williams and Dr. Wayne Jouse.

Please advise me if there is additional information that we should supply.

Sincerely yours,



Michael A. Cusanovich  
Vice President for Research

MAC/ce  
attachments

A/116

APPEAL OF NOTICE OF TERMINATION, Grant No. NRC-04-93-089

Prepared by John G. Williams, June 27, 1995

Attachments supplied by Dr. Jouse

1. Root Cause of the Problems

The root cause of the problems encountered in the management of this grant can be traced to inconsistencies in the application of published NRC criteria for review and evaluation of this program. The Federal Register Notice (Vol. 57, No. 19, p3445) states the following, under the heading "Factors Generally Indicating Support Through Grants:"

The NRC's benefit from the results of grants should be no greater than other interested parties, i.e. the public must be the primary beneficiary of the work performed. Surveys, studies, or research which provide specific information or data necessary for the NRC to exercise its regulatory or research mission responsibilities will not be funded by a grant. Applicants requesting support for work which has direct regulatory application should submit their requests as an unsolicited proposal for consideration as a contract rather than a grant.

In contrast to this, Mr. Robert Brill, on 2/14/94 shortly after the commencement of the work, stated on the telephone to Dr. Jouse (contemporary notes taken by Dr. Jouse):

"The role of NRC research is to establish a basis for regulation."

The Federal Register Notice previously cited continues:

1. The primary purpose of NRC grants is to support the development of knowledge or understanding of the subject or phenomenon under study.
2. The exact course of the work and its outcome are usually not defined precisely, and specific points in time for achievement of significant results need not be specified.

Mr. Brill, however, in his letter dated Mar 10, 1994, criticizes the first bi-monthly report submitted by Dr. Jouse as follows:

"I had anticipated that you would have, by this time, set up a step-by step plan in a form which clearly states the goal for each step, pass-fail criteria, deliverables, and milestone dates."

This particular mismatch has continued to bedevil the project throughout, culminating in the following quotation in the Notice of Termination of Section 2 of the NRC General Provisions:

Recipients are responsible for the performance under grants and other agreements and where appropriate, ensure that time schedules are being met, projected work units by time periods are being accomplished, and other performance goals are being achieved.

The words "where appropriate" are operative here. The context provided by the NRC program announcement shows that predetermined time schedules are not appropriate in the case of meaningful technical reports. The previously cited Federal Register Notice continues:

3. The NRC desires that the nature of the proposed investigation be such that the recipient will bear prime responsibility for the conduct of the research and exercise judgment and original thought towards the attainment of scientific goals within broad parameters of the proposed research areas and the resources provided.
4. Meaningful technical reports (as distinguished from Semi-Annual Status Reports) can be prepared only as new findings are made, rather than on a predetermined time schedule.
5. Simplicity and economy in execution and administration are mutually desirable.

Mr. Brill's previously cited letter (Mar 10, 1994) contradicts item 3. of the above, when he states:

"The objective was to 'develop and demonstrate an active information system which is capable of detecting controller faults on-line.' The goal of the research 'is to develop a software system, based on associative stochastic automation, which has the capability of detecting controller faults.'

I find your statements in the area 'global focus' inconsistent with the above research objective and goal. There may be a dividend from your research which meets the global focus you are addressing, but that stated focus is outside the scope of the grant you have received and needs immediate correction."

Lest there be any doubt of the degree of discretion that Mr. Brill finds appropriate for the investigators, he later states (letter of Mar 10, 1994):

"Editorially speaking you need to keep to the third person. Your report is inconsistent in this area. Readability would be significantly improved if you

use current business formats which block paragraphs and skip a line for new paragraphs as this letter has done."

Notwithstanding their concerns about the apparent failure of NRC project management (this includes, but is perhaps not limited to, Mr. Brill) to understand basic research as stated in the Commission's own announcement of its goals, the investigators have made good faith efforts to adhere to the program goals, while at the same time attempting to satisfy the inconsistent demands placed on them by project management. This has been difficult, to say the least, and we repeat our earlier assertion that the root cause of the problems that resulted in the issuance of the Notice of Termination has been the failure of NRC to apply its announced criteria.

## 2. Submission of Reports.

Reference will be found in the preceding section both to "bi-monthly" and to "Semi-Annual" reports. The Notice of Termination also refers to "bi-monthly" reports and also quotes the NRC General Provisions which requires "Performance reports ..... in letter format within 30 calendar days after the end of every second calendar quarter." In addition to the semi-annual reports, the Notice of Grant Award specifies an "Interim Report" at the conclusion of the first year, i.e. within 30 days from 31 December. Nowhere in the contractual material related to this Grant can a requirement for bi-monthly reports be found.

How then, did the bi-monthly reports arise? The answer is that they were required by Mr. Brill, who, in this respect and in others, took it upon himself unilaterally to impose conditions that were no part of the contractual agreement. As a result, Dr. Jouse has submitted, so far, a total of seven reports during the first sixteen months of the project. According to the contractual requirements, the number of required reports during this period was two: one semi-annual report and one "Interim Report." Regrettably, the only report that Dr. Jouse missed was that due at the end of the first year. He states that a report was prepared at this time, but not submitted due to an oversight. This omission led to the actions to which we are now responding. The submission of a total of seven reports by Dr. Jouse is relevant for the following reason: The Notice of Termination states that the report provided dated March 16, 1995 was determined inadequate as a summation of a year's work. That may be so, and a summation may have been expected, but we believe that account should be taken of the five reports previously submitted. NRC project management must accept its share of responsibility for confusion over reporting requirements, in view of the departures from contractual requirements instigated by Mr. Brill.

### 3. Communications from NRC.

The NRC General Provisions, Section 3. Suspension or Termination for Cause, paragraph b. , states, in part:

NRC prefers that deficiencies be corrected whenever practicable. When it is believed that a recipient has failed to comply ..... the Grants Officer will advise the recipient by letter of the nature of the problem and that failure to correct the deficiency may result in suspension or termination of the award. The recipient will be requested to respond in writing within 30 days of receipt of such letter, describing the action taken or the plan designed to correct the deficiency. Copies of such correspondence will be furnished to the Principal Investigator (PI) and to the NRC Program Officer. If a satisfactory response is not received within 30 days .... the Grants Officer may issue a notice suspending authority to further obligate award funds, in whole or in part. The notice of suspension will be sent by certified mail (return receipt requested, to the recipient with a copy to the PI.)

The above policy has not been followed in full, and this has resulted in the investigators being deprived of the intended opportunity to respond. None of the correspondence from the Grants Officer was in fact received from the Grants Officer by the PI . The Notice of Termination shows:

"cc:  
Peter F. Mather, Associate Director  
University of Arizona  
Office of Research and Contract Analysis  
2030 Speedway Blvd., #222  
Tucson Pima County, Arizona 85719

Dr. Wayne C. Jouse, University of Arizona  
George Martinez, University of Arizona  
J.G. Williams, University of Arizona."

Despite this, no copies were transmitted to Dr. Jouse or Dr. Williams, who are respectively PI and co-PI for the Grant. Dr. Williams received a copy ( dated May 23, and marked Received by Sponsored Projects on May 30) on June 16, as a result of a conversation with the Dean of his College, Dr. Ernest Smerdon, who was surprised, because of the cc line quoted above, to learn that Dr. Williams had not seen it. Dr. Jouse did not see the document until June 22, when Dr. Williams provided him with a copy.

Previous correspondence also failed to reach the investigators in a timely manner. The Notice of Termination refers to a letter dated March 8, 1995, from the Grants Officer to Mr. Wheeler, presumably pursuant to the paragraph cited above of the General Provisions. The reason why this did not reach Dr Williams until after the expiration of the 30 days period specified for a reply is not known, but if a similar "cc" statement to the above



appeared on it, this would explain why it was not transmitted to him by Mr. Wheeler (Dr. Williams has not received any copy of this letter to this day.) The fact that the Grants Officer found the response to her letter insufficient must be understood in the context that the investigators were deprived, by reason of the faulty communications, of the opportunity to provide a satisfactory response.

The letter of March 8, 1995, was not the first action taken by the NRC Contracts Division in relation to this Grant. On or about July 20, 1994, the PI learned from the Sponsored Projects office of the University that NRC had suspended payments on grounds that Mr. Brill had alleged that he had been unsuccessful in obtaining information he required from the PI concerning a timeline of milestones and dates. It should be noted that at this time no report was overdue. The first report required by the contract was the semiannual report required within 30 days from June 30, 1994, which had in fact been transmitted on July 11 (copy provided herewith, see attachments). This report included the requested timeline. Frustrated by previous unsuccessful attempts to satisfy the Project Officer's needs, the PI, Dr. Jouse, asked Dr. Williams (co-PI) to contact Mr. Brill. Dr. Williams learned that Mr. Brill was on leave and, as a result, he spoke instead to Mr. J. Cramer (we believe that Mr. Cramer is Mr. Brill's supervisor.)

Dr. Williams made the following points to Mr. Cramer: (1) he found it strange that the investigators should first learn of the adverse action from their contracts office, and that no warning was given by Mr. Brill before his departure on leave; (2) the required timeline had been submitted, and was not late; (3) the demands by Mr. Brill for a specific form of report constituted a unilateral imposition of conditions not specified in the contract; (4) the investigators had been, and were, willing to enter into a dialogue concerning the form of reporting needed and would comply with reasonable requests, as the submission of the requested timeline showed; (5) the unexpected and unwarranted suspension of payments was an extreme action which had the potential to severely disrupt the project and impose hardship, particularly on the student supported by the grant.

As a result of this conversation, Dr. Jouse supplied Mr. Cramer with copies of his previous correspondence with Mr. Brill, and the suspension of payments was removed. Subsequently, Mr. Brill telephoned both Dr. Williams and Dr. Jouse. During one of these conversations, Dr. Williams commented that the degree and style of control that Mr. Brill was exerting might be typical of a Contract but not a Grant (alluding to the distinction drawn in the Federal Register Notice previously cited). Mr. Brill replied that this was a Contract. During a conversation with Dr. Jouse, Mr. Brill used the expression that he had been "pulling your (Dr. Jouse's) chain." After this, Dr. Williams warned Dr. Jouse not to give any pretext for retribution. Unfortunately, the later failure to transmit an Interim Report on time provided such an opportunity. Both investigators believe that subsequent events are rooted in this earlier incident.

In view of the previous difficulties, the communications between Dr. Jouse and Mr. Brill of January 23, 1995 and April 10, 1995, referred to in the Notice of Termination, were unwise. The investigators are aware that informal communications with the NRC, including telephone calls, may result in formal actions, when regulatory matters are

concerned. It is salutary to find that we must also guard our tongues when dealing with NRC Project Officers.

#### 4. NRC Criticisms of Interim Report dated April 27, 1995.

The Notice of Termination states that the April 27th report was determined to be unsatisfactory for several reasons.

1. This late submittal did not adequately reflect the work accomplished and how well the performance goals for 1994 were achieved.

The report was indeed late. Part of the reason was an oversight by the PI. Part of the reason was the faulty communications by the Grants Officer mentioned previously. No notice of this problem was given by the Project Officer. The remainder of the criticism is vague. "Performance goals for 1994" were not specified.

2. In identifying a significant difficulty encountered, the report simply stated the problem, with no discussion of how the grantee proposed to solve the problem. ....

Two examples are cited. The criticism of the second example is incorrect. The problem identified is that the selection of the feature space is constrained by the availability of plant data. the two following paragraphs deal with the solution to this problem which "involves selecting and/or extracting only features containing relevant information." a two step procedure is outlined and an example is given in which, "In this spatial representation, the effect of the failure on the system is distinguishable from normal operational transients." On page 2 of Dr. Jouse's report, some other problems encountered during the modeling process were described (numbered i) through iv)). details of the solutions are not given, but the following paragraphs clearly indicate that these problems were solved and give specimen results from the working model.

3. The report contains numerous unsubstantiated and general statements. For example, page 4 notes: "There are many paradigms available to automate this decision making process...." The grantee did not explain which technique will be used, or if a decision has not been made as to techniques, what the basis of choice will be.

The statement from Dr. Jouse's report gives, as examples, two possible techniques: multi-linear perceptrons and associative stochastic automaton (ASA). The following paragraph discusses the method of configuring the ASA for this task. It was assumed that the reader would know that the proposal for which this Grant was awarded specifies the use of ASA:

**Goals:** The goal of this research is to develop a software system, based on associative stochastic automaton, which has the capability of detecting controller faults. (Automatic Detection of Digital Plant Controller Faults, Jouse and Williams, proposal, 2/03/93)

The criticism in the Notice of Termination concludes:

Overall, it was expected that the report would be a reasoned treatise of progress to-date, communicating what had been learned, identifying problems with proposed solutions, and defining how choices were made for competing techniques, including substantiated statements for the selected techniques.

These are reasonable expectations. On the other hand, on Mar 10 , 1994, in his criticism of Dr. Jouse's first attempt to satisfy Mr. Brill's needs, the latter wrote:

"Your report need not include the why's as you have done, together with mathematical formulas."

##### 5. Conclusion.

We did miss one deadline for an Interim report, but the NRC's response is disproportionate, and we believe the reason for this is traceable to misunderstandings arising from the previous mismanagement by the NRC and which have been documented above.

Resulting from these problems, the investigators' reputations as responsible and productive researchers have been smeared. This appeal requests fair consideration of the totality of these circumstances, and proper attribution of the responsibility for the mismanagement of this Grant.

The investigators regret that this response has, of necessity, focused on procedural and administrative matters. We would have preferred to adhere to the ideal stated in the Federal Register Notice , as previously quoted:

Simplicity and economy in execution and administration are mutually desirable.



College of Engineering and Mines  
Department of Nuclear and Energy Engineering

June 22, 1995

THE UNIVERSITY OF  
**ARIZONA**  
TUCSON ARIZONA

Tucson, Arizona 85721  
(602) 621-2551  
FAX (602) 621-8096

Memo to: Dr. John Williams

From: Dr. Wayne Jouse *wj*

RE: Termination of grant: NRC-04-93-089

Thank you for providing me with a copy of the notice of termination and for your letter dated June 22. For your immediate receipt, please find attached a chronologically arranged copy of my records on this matter. Additionally, I have requested that CCIT reload past files.

Perhaps the best manner in which to proceed is to jointly discuss the evolution of the communications with both Robert Brill, the Program Manager, and Joe Cramer, his immediate supervisor.

cc: Ernest Smerdon  
Barry Ganapol

## RECORD OF CONVERSATION

2/14 DOLORES WALLACE

- NEW NIST DIRECTOR HAS DISRUPTED NORMAL COURSE OF EVENTS. DOLORES IS UNSURE OF HER FINANCIAL CAPABILITY UNTIL THINGS SETTLE DOWN.
- SHE LIKED OUR CONCEPTS & PROJECT DIRECTION - IT GOES IN THE "FUND IF POSSIBLE CATEGORY"
- ALTERNATIVE - ATP TO HAVE OPEN SOLICITATION IN APRIL

- CALLED RESEARCH OFFICE / NEED ATP INFO

2/14 ROBERT BAILEY

- CALLED TO ASK WHAT HE NEEDED IN 3 MONTHS
- GLOBAL OVERVIEW - THE ROLE OF NRC <sup>Recall</sup> IS TO ESTABLISH BASIS FOR REGULATION. A MAJOR CONCERN IS THE UNINTENDED FUNCTIONING OF SOFTWARE SYSTEMS. IT IS NOT POSSIBLE TO TEST 100%. CAN A BASIS BE ESTABLISHED WHICH DEMONSTRATES THAT UNINTENDED FUNCTION BE DETECTED?
- TALK ABOUT REGULAR MTGS, PERSONNEL, LOCAL OBJECTIVES, PROGRESS

## BRILL/OTHER TOPICS

## • CURRENT NRC ACTIVITY -

"WHAT IS BASIS FOR SOFTWARE?"

## • TWO LEVEL REVIEW IN PROGRESS

MITRE CORPORATION - ANALYZED SPECIFICATIONS

IEEE 1012, IEC 880, IEEE 7432, JOD 855 (British)

- development process { requirements  
coding  
dev
- quality assurance { readability,  
completeness  
unambiguous
- identify if basis exists, what research needs to be done (CARROT)

## • TWO GROUPS EXIST

- 15 OUTSIDE EXPERTS
- 2<sup>nd</sup> GROUP NOT FORMED
- if want to be part of review, { APRIL 22 transmitted  
MAY 13 return

! CALL BACK AFTER DISCUSSING WITH GROUP

## • NO FIRST PRINCIPLES FOR SOFTWARE DESIGN !

- John Knight (Virginia) - Formal Specifications
- Rushby (SRI) - formal spec. language
- HALORN (Norway) - proper formal spec. & key.

## • TIMING PROBLEMS

- IF (A), THEN (B) 10 sec. later.
- HARD TO PUT IN FORMAL SPEC. MACHINES

! Most reliability problems come from problems with formal specifications !

Detection of Unintended Functions  
February 22, 1994

W.C. Jouse  
University of Arizona

Mr. Robert Brill  
U.S. Nuclear Regulatory Commission  
Washington, D.C., 20555

RE: Project Summary for January and February, 1994

Dear Bob;

This is the project summary for the first two months of 1994.

#### *Global Focus*

The focus of this project is to generate a technical basis for the regulation of high integrity software and control systems. The establishment of a technical basis provides a standard against which other system structures can be compared.

The role of this project in the generation of a basis for high integrity software is to address the detectability of unintended software functioning. This project will demonstrate that unintended software functioning can be detected, and to describe and delineate the types of unintended functionality which may be detected.

#### *Personnel*

At this time, the project is providing hourly support for C.J. Parisi. Mr. Parisi is a last-semester senior. He will be attending graduate school at the University of Arizona in the fall, and will be involved with this project in this capacity. Presently, no funds are being drawn by Dr. Jouse although he is active in the research effort.

#### *Local Objectives and Planning*

The immediate objective is to familiarize the working group with control structures and jargon. To this end, CJ and I are meeting weekly. His readings have been in fuzzy control. Fuzzy control systems offer us the opportunity to understand control structures in a 'natural language' environment. Also, the cellular structure of fuzzy controllers has many analogs in the stochastic networks which I have been working with.

In the near term, it seems advantageous to structure and code a discrete-state Markov system, which is a probabilistic description of a system, such as a controller. By examining such a system, we will better be able to describe and isolate the characteristics of an error detection system.

If there are any suggestions, questions, or concerns, please call.

Wayne C. Jouse  
Rm 200, Old Engineering Bldg  
University of Arizona  
Tucson, AZ, 85721  
(602) 621-2401

*Detection of Unintended Functions*  
March 1, 1994

W.C. Jouse  
University of Arizona

Mr. Robert Brill  
U.S. Nuclear Regulatory Commission  
Washington, D.C., 20555

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In the near term, it seems advantageous to structure and code a discrete-state Markov system, which is a probabilistic description of a system, such as a controller. By examining such a system, we will better be able to describe and isolate the characteristics of an error detection system.

#### *Accomplishments*

The primary accomplishment for this period was the structuring of a fuzzy-logic controller and the structuring of the fault-detection problem for a linear system.

Fuzzy controllers are becoming more popular because of recent report of successful applications and because they are implemented in natural language. One concern which has recently been researched is that the fuzzy "controller(s) are hard to optimize or tune to get the desired performance" [R.M. Edwards, et al, IEEE Trans Nucl Sci 40, 4, Aug 1993, pg 1253-1262].



The structure of a fuzzy controller is developed in seven steps;

- i) Identify the system actuators and the range of process variables.
- ii) Identify the salient and/or observable features of the system.
- iii) Attach semantic labels to the features.
- iv) Shape the membership functions.
- v) Design the control schedule based on crisp sets
- vi) Design and implement a the defuzzifier / controller
- vii) Implement and test

The advantage of this approach is the use of natural language in the synthesis of the control schedule. The use of natural language facilitates the shaping of the schedule. The resultant schedule is (hopefully) isomorphic to the mental images of the system's behavior existing in the consciousness of the designer. During the implementation, the morphism is tested, and subject to review and modification.

This paradigm has several disadvantages, also. The use of natural language violates one of Parnas' views that natural language is insufficient for purposes of system specification. Also, it is not clear how the designer would proceed to synthesize control schedules for multi-dimensional, multi-signal problems.

The next item addressed was the structuring of a fault-detection paradigm for a scalar, time-invariant linear dynamical system. The internal structure of such a system is governed by the discrete-time dynamical equation

$$X^{k+1} = aX^k + bU^k \quad X^0 = X_0$$

where  $X$  is the state of the system,  $U$  is the control signal, and  $a$  &  $b$  are constants. In the three-space spanned by the set  $\{X^{k+1}, X^k, U^k\}$  the unfaulted dynamics of the system lie on a single plane. Hence, it is possible to detect system faults by constructing a discrimination function based on it.

This pretty well wraps it up for this time. If there are any suggestions, questions, or concerns, please call.

Wayne C. Jouse  
Rm 200, Old Engineering Bldg  
University of Arizona  
Tucson, AZ, 85721  
(602) 621-2401