Enclosure (1)

Final Report for

Contract No. DE-AC-01-83ER-52095

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Grumman Aerospace Corporation

Suite 301 - 1803 Research Boulevard, Rockville, Maryland 20850

September 30, 1986
TSS-PSR86-012

Project Status Report and Final Report
Technical Support Services (TSS) for the
Magnetic Fusion Reactor Design Studies Program

DOE Contract Period:

1 September 1983 - 31 August 1986

Report Period:

1 July 1986 - 30 September 1986

1. CONTRACT OBJECTIVE:

Contract objectives will be changed to focus on international collaboration. This report constitutes the Final Report of the DOE contract for Technical Support Services conducted from the local Grumman office at Rockville, Maryland. The contract extension will provide only for the services of Dr. M. B. Gottlieb as subcontractor to Grumman, and operating out of the Grumman office at Plainsboro, New Jersey. Mr. Gordon T. Woodruff will serve as manager of the TSS contract. The local office will be closed as of September 30, 1986.

2. TECHNICAL APPROACH CHANGES:

The contract initially provided full-time technical support from four Grumman TSS participants:

Mr. Donald L. Moyer, TSS Manager
Mr. John Erickson
Mr. Erick Stern
Dr. Carl von Keszyski

Support equivalent to one full-time participant was also provided by three subcontractors. Key subcontractor personnel were the following:

Dr. Betty Jensen, Public Service Electric and Gas Corporation
Mr. Paul Gillum, Boeing Engineering Company
Mr. William Rasin, Duke Power Company

The services of Dr. Melvin Gottlieb were added as a fourth subcontract starting in August 1984.

Additional technical support was provided throughout the contract period by Grumman and subcontractor personnel in response to specific task assignments.

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The TSS staff was reduced October 1984 in response to OFE budget reductions by the release of TSS participants Mr. Erick Stern, Grumman Aerospace Corp, and Mr. Paul Gillum, Boeing Engineering Co.

Mr. William Rasin, TSS participant from the Duke Power Company was replaced by Mr. Michael Barrett in January 1985. Mr. John Erickson, Grumman TSS participant was replaced by Mr. Paul Ambro in September 1985.

The TSS staff was again reduced in October 1985 by the release of Dr. Betty Jensen, Public Service Electric and Gas Corporation. Recent reductions consist of the release of Mr. Paul Ambro, Grumman TSS participant, and Mr. Michael Barrett, Duke Power Company, as of September 1, 1986 and Dr. Carl von Keszycski and Mr. Donald Moyer, Grumman TSS participants, on September 30, 1986.

The contract is expected to continue through the duration of the full five-year period with technical services being provided by Dr. Melvin Gottlieb.

3. CONTRACT TASKS:

General Tasks

INTERNATIONAL COLLABORATION - Dr. Melvin Gottlieb participated in planning activities conducted by OFE and ER in pursuit of opportunities for international collaboration on fusion devices and supporting technology that will be needed in the future. This activity involved visits to Europe and Japan to consider options, formulate plans and participate in international meetings and conferences. Dr. Gottlieb served as the chairman of the U.S. Delegation to the Summit Working Group's Technical Working Party (TWP). The first two meetings of the TWP resulted in a general endorsement of the U.S. plans for a Compact Ignition Experiment and an Engineering Test Reactor as a possible medium-term goal for a program of international collaboration. The third meeting of the TWP addressed the field of fusion materials, particularly in the interests of making fusion power even more attractive. Specific recommendations were made regarding increased collaboration in this field including common use of existing facilities. The next TWP meeting will concentrate on concept improvement within the tokamak field and alternate concepts as well.

MAGNETIC FUSION POLICY PLAN - A suggested revision of the Magnetic Fusion Policy Plan was prepared following review of the initial OFE plan released on September 14, 1985. The objective of this revision was to present the current OFE policies in a more favorable light by emphasizing realism in program planning, technology transfer and opportunities for industrial participation. Changes to current policies were specifically excluded from this activity.

CONGRESSIONAL REPORT - Development and coordination activities were conducted in the preparation of a draft response of OFE to the Congressional request of Conference Report 99-307. The requested report presented progress and potential of current research programs as measured by the following factors:

- o Mass Power Density
- o Cost of Electricity
- o Plasma Confinement Efficiency
- o Safety and Environmental Considerations.

The report was enhanced through the review and critique of numerous members of the fusion community and was submitted in support of the FY'87 budget request for the magnetic fusion program.

MEETING COORDINATION - A general study of fusion meetings was conducted under the direction of TSS participant Ron Endicott to determine means of coordination and to define scheduling guidelines that might reduce conflicts, and eliminate avoidable travel.

A scheduling program was produced with the cooperation of LASL personnel and is operational on the MFECC System. The program includes a master schedule of meetings in the VAX computer at LASL which can be accessed through a date or keyword selection and a 30 day meeting summary in the FILEM routine of the LLNL Cray. The meeting schedules were maintained by TSS member Carol Noble through the TSS office in Rockville from January 1985 thru the end of this contract period. The system has been used by a few individuals and organizations. Plans to conduct an official trial operation are still being contemplated.

MFAC PANEL XIII - Panel XIII of the Magnetic Fusion Advisory Council was charged with the review of the Reactor Systems Studies program of OFE. Material defining the purpose, approach and history of these efforts were prepared for presentation to the panel on May 15, 1985, in Atlanta, Georgia. The panel report (July 1985) provided general endorsement of system study efforts, but questioned the low level of funds spent on commercial power studies and their ratio compared to study funds for near-term experimental devices. The report recommended a decrease in the percentage of total study funds to be spent at the Fusion Engineering Design Center and found no need for TSS efforts which were characterized to be administrative in nature.

Discussions with Dr. Stacey, panel chairman, established that clarification of the TSS comments was appropriate since the term "administrative" is subject to various interpretations. The findings of the panel as initially reported were generally endorsed by a subsequent MFAC subpanel and were forwarded to O.E.R. in November 1985. Our concerns were again expressed in a letter to MFAC on November 20, 1985, but no response was received.

FUSION ENERGY EDUCATIONAL DEVELOPMENT SEMINAR (FEEDS) - Carol Noble of the Grumman/TSS office participated in the development seminar conducted at MIT and the University of Rochester on May 19 through 24, 1985. The seminar program is considered to be effective in both an educational sense and by the establishment of closer working relationships throughout the fusion community.

EPRI FUSION PROGRAM - Mike Barrett of Duke Power participated in the EPRI-Fusion Program Status and Technology Forecast Workshop at La Jolla, California, in October 1985. The workshop is expected to influence the future of the EPRI Fusion Program.

INERTIAL FUSION - Paul Ambro participated in the Inertial Fusion Systems and Application Colloquium at the University of Wisconsin in October 1985. It would appear that opportunities will exist where the Inertial Fusion and magnetic Fusion Programs can derive mutual benefits from experiment, study and technology development efforts.

TSS ADVISORY BOARD - An Advisory Board consisting of senior corporate officials of Grumman and TSS subcontract organizations was formed to directly contribute to on-going TSS activities. The concept was established to draw on the expertise of individuals who had played key roles in the formation and success of major programs involving the development and application of high risk technologies. Six meetings of the TSS Advisory Board were conducted over the course of the three year contract.

Task Area 1 - Systems Studies Work Plan

Work plans were developed and revised through the course of conducting reviews of study efforts, proposals, and OFE priorities. These efforts provided direct support to internal OFE planning activities, helping to formulate study approaches, task/team assignments and budget distributions. TSS activities started with the review of on-going FY'84 and earlier study efforts, and later provided support through the normalization and interpretation of study results. TSS personnel did not participate in TFCX study efforts due to the industrial competition that was being conducted.

TOKAMAK POWER SYSTEMS STUDIES (TPSS) - Planning efforts were initiated in FY'84 to consider a proposed update to the 1980 "STARFIRE" study of a commercial Tokamak Fusion Power Reactor. This "STARFIRE II" study would incorporate up-to-date results of all study and development efforts regarding tokamak reactor systems. The development of the study progressed through an initial planning meeting where a framework for a "formal" study was defined. Subsequent considerations endorsed a coordinated set of independent activities in the interest of promoting greater innovation and avoiding a repetition of the "big," "ugly" STARFIRE image. TSS members Erick Stern and John Erickson played major roles in planning and coordinating the individual TSS study activities.

MiniMARS SYSTEMS STUDY - The study of commercial Mirror Fusion Power Reactors continued as a follow-up to the Mirror Advanced Reactor Study (MARS) with studies of a Fusion Power Demonstration (FPD) mirror reactor and a MiniMARS study. MiniMARS promised significant improvements in mirror reactor attractiveness by exploiting new innovative concepts and the potential of fusion for passively safe operation. TSS member John Erickson participated with LLNL personnel in the planning and coordination of these study efforts.

TITAN RFP STUDY - The potential of alternate fusion concepts for the generation of commercial electrical power is being explored by studies initiated in FY'86. TSS member Paul Ambro participated in the planning and review of these efforts.

IGNITION STUDIES - Various approaches and organizational structures were considered in the formulation and planning of Tokamak Ignition Studies to be started in FY'85. The resulting approach identified two missions:

- 1) to identify options for a minimum cost experiment with minimum performance objectives through a group of independent studies. These studies, structured to encourage innovation, primarily addressed tokamak concepts involving the use of conventional "copper" magnetic coils.
- 2) to develop an experiment that will either provide improved performance over that of the TFCX at the same cost as TFCX or will provide performance equivalent to TFCX at a reduced cost. This study was structured to coordinate the efforts of individual participants and was to address tokamak concepts using super-conducting magnet systems.

TSS participation in the planning of Ignition Studies also included the arrangement and planning of initial workshop meetings. TSS member Dr. Carl von Keszycski served on the Design Coordination Committee of the Ignition Experiment studies, was the chairman of the Ignition Studies Task Force, and provided support to the DOE Working Group.

ETR MISSION STATEMENT - A mission statement defining the purpose and objectives of the anticipated Engineering Test Reactor (ETR) was prepared by the TSS staff in FY'84 to provide guidance to current Reactor Design Studies in preparation for future ETR definition and design activities. The ETR mission statement was subjected to review within OFE and by a selected review committee prior to its release.

INTERNATIONAL ETR - Planning activities regarding systems studies in support of an engineering test reactor as a program of international collaboration were initiated in FY'86. It is assumed that an international organization will be established to develop and promote the program and that the program goal will be to produce a tokamak facility capable of fully confirming the scientific feasibility of fusion and conducting engineering tests of blanket modules relevant to the design and operation of fusion reactors. LLNL will be the lead laboratory on this program and the TIBER design concept as produced in previous ignition studies will be adopted as a cost-effective, but technically relevant approach to the ETR design. TSS members Dr. Carl von Kesztycki and Don Moyer supported these planning activities.

Task Area 2 - Normalization of Reactor Design Studies

TSS efforts in this task area were initiated by preparing definitions for all parameters to be used in normalization and comparison activities. Repeated review and revision of this parameter set were anticipated, but never materialized as only a very few comments were received.

SYSTEM COSTING - The formulation of a Uniform Cost Accounting System was planned through a series of discussions/meetings and progressed under the direction of FEDC. TSS members Paul Gillum, John Erickson and Don Moyer participated in this effort through the adoption of an initial system to normalize cost estimating and reporting activities for all OFE efforts. It was anticipated that the resulting system would address proposed experimental systems such as TFCX and options for Ignition machines, engineering machines as may be required for interim development efforts, and power systems such as STARFIRE and MARS. The resulting computer models for cost estimating were used extensively in support of the design studies of the Compact Ignition Tokamak experiment as well as all fusion power reactor studies. This system is continually gaining in value as modifications are incorporated to refine estimating algorithms and to provide routines for automated cost optimization in terms of selectable design parameters.

COST COMPARISONS - Cost comparisons of projected fusion and fission systems were made by TSS participant Jim O'Neill based upon the STARFIRE and MARS studies and the DOE Report, "Projected Costs of Electricity from Nuclear and Coal-Fired Power Plants for 1995 Startup," DOE/EIA-0356/1, December 1982. These comparisons showed the resulting COE of fusion power to be within 20% of fission costs even though the initial capital costs of fusion plants are considerably greater. Coordination and normalization efforts were conducted in cooperation with other cost investigators including Les Waganer of MDAC and John Sheffield of ORNL.

The attractiveness of small reactors was repeatedly examined throughout the TSS contract period. Although the potential for lower capital cost is always attractive, the basic conclusion remains that individual utilities or cooperative groups of utilities will ultimately procure plants whose costs are perceived to be realistic, i.e. low risk is of greater importance than low cost.

Report material was prepared in response to the congressional requests of Conference Report 99-307 for cost comparison and concept ranking information in support of the FY'87 budget. The material defined the usefulness and limitations of figures-of-merit, normalized estimates of Unit Direct Costs, Cost of Electricity and Mass Power Density and defined goals for Plasma Confinement Efficiency and Safety for candidate power reactor concepts. The material incorporated the work and critique of system study participants throughout the fusion community.

SYSTEM AVAILABILITY - The definition of Availability terms, goals and potential data bases for fusion power reactors has progressed under the direction of FEDC. TSS member Bill Rasin initiated this effort by conducting workshops and supporting the preparation of plans and recommendations for future availability efforts. It is anticipated that the development of availability data bases will take advantage of the experience gained from existing experimental machines. Data base values will be used in the projection of availability estimates for future experiments as well as developmental and operational systems.

The study of system availability continued with the formation of a Fusion Availability Working Group (FAWG) to initiate the collection of information for an availability data base and to address availability projections to be included in Reactor Systems Studies. The first meeting of the FAWG was held in the TSS offices, Rockville, Maryland, on August 19, 1985. TSS member Mike Barrett served as chairman of the FAWG.

SAFETY - A workshop was conducted in Chicago, Illinois, on November 13, 1985, to establish an understanding among the fusion community regarding design approaches for safety and associated savings/cost factors. While general agreement exists on the definition of terms (inherent safety, passive safety, etc.), wide-spread misuse abounds and produces significant confusion. Benefits produced by the inherent safety aspects of fusion power reactors can only be appreciated when safety issues are addressed in a rational and consistent manner.

MULTIPLEXING - A special workshop was conducted at the TSS offices in Rockville, Maryland, on July 9, 1985, to review the concept of multiplexing as applied to fusion power reactors in system studies. TSS member John Erickson served as chairman of the workshop. Whereas multiplexing could improve the availability of a

power plant (reducing COE), the required cross-connections would introduce complexities that would tend to offset the gains. Multiplexing is not seen as a significant means of enhancing current concepts and is not expected to enhance future systems studies.

QUALITY ASSURANCE - The third Fusion Quality Assurance Workshop was held at PPPL on July 24-26, 1985. The objective was to again exchange ideas, share problems and develop methods for improving the effectiveness of individual QA programs. The role of QA in experimental programs was thoroughly examined. Positive attitudes and constructive discussions produced meaningful results.

Various TSS efforts have considered cost impacts of projected fusion and fission power plants with respect to quality assurance/quality control and size. These issues are related because it is anticipated that individual utilities or cooperative groups of utilities will ultimately procure plants whose costs are perceived to be realistic. Evidence of an effective quality assurance program designed to eliminate risks throughout the early development is therefore expected to be of greater significance in selling fusion power than are estimates of competitive costs.

Task Area 3 - Interpretation of Design Study Activities

Activities in Task Area 3 were initiated by an attempt to prepare a report regarding the Viability of Fusion Power. This task was abandoned as budget constraints forced the release of TSS personnel and tasks involving planning and review were afforded higher priority. TSS personnel conducted/participated in the review of design study activities and submitted 128 reports to document specific observations and conclusions. The following are major study efforts that were significantly influenced by TSS participation.

TOKAMAK POWER SYSTEMS STUDIES (TPSS) - Advances in theory and experimental results for tokamak systems subsequent to the STARFIRE study suggest a more attractive potential for commercially available power. These advances were considered in a group of separate study efforts. The concept of separate studies was selected to encourage innovative thinking in the development of individual/alternate options. The results of FY'85 efforts were reviewed in a meeting at MIT, August 12-14, 1985, with the objective of defining efforts to be pursued in FY'86. The consensus was that the Spherical Torus and Elongated Torus, as means to achieve higher Beta, were too speculative to warrant further attention. The use of Second-Stability physics was generally approved. The ECH tokamak studies by UCLA was largely a technological problem, but needed more help from the transport theoreticians. The self-pumped impurity control devices proposed by ANL looked promising both in practicality and potential pay-off.

It followed that the most likely design to carry forward would be a self-pumped second stability tokamak with as many of the following characteristics as possible: high beta with low plasma current, passive safety, the benefits of small size, the thin blanket/shield associated with self-pumped limiters, effective current drive high thermal efficiency and energy multiplication, longer lifetimes and shorter maintenance times. The results of FY'84 and '85 TPSS studies were documented in a final report by ANL. These results are currently being integrated into a consistent reactor design.

FUSION POWER DEMONSTRATION (FPD) STUDIES - Design studies conducted in FY'84 produced three FPD configurations (I, II, & III). FPD-I is a MARS-like configuration scaled down to 360 MW. FPD-II has smaller plug coils and a driven test cell to produce high flux and fluence over a limited section of the center cell. The FPD-III configuration features an end cell design using an octopole anchor/plug coil. System codes were modified to model the anticipated performance of the octopole magnets. The change from the MARS-like end-plug to the octopole introduced many new questions and uncertainties in addition to the promise of dramatic improvements in the attractiveness of tandem mirror power reactors.

MiniMARS SYSTEMS STUDY - The MiniMARS study was started with a kick-off meeting on October 10, 1984. MiniMARS promised a significant improvement in mirror reactor attractiveness by exploiting new innovative concepts and the potential of fusion for passively safe operation. Reuniting the University of Wisconsin with LLNL added viability to the study and produced the following results:

- o A 600 MWe baseline design has been found to yield a COE of the order of 60 mils/kWhr.
- o The Tandem Mirror System Optimization Code exhibits a moderate nuclear economy of scale.
- o Passive (inherent) plasma shutdown can be achieved and afterheat temperature effects can be controlled by thermal radiation.
- o Wall stabilization effects in MiniMARS are significant and would be enhanced in future designs.
- o The mass utilization threshold of 100 kWe/tonne as recommended by MFAC Panel X does not seem consistent with cost-optimized MiniMARS configurations.

The baseline design was frozen and an interim report was distributed in January 1986. A final report of this work was presented in Toronto, Canada, in May 1986, and will be documented by the end of FY'86. No mirror study efforts are planned for FY'87.

TITAN RFP STUDY - The planned three year study of RFP options for power reactor designs was initiated with a kick-off meeting at UCLA in December, 1985. The study is directed by Prof. R. Conn of UCLA and managed by Ken Schultz of GA Technologies. The study is conducted in accordance with the recommendations of MFAC Panel 10 regarding the potential of alternate concepts for fusion power. The study is progressing as anticipated and is receiving the benefits of community participation through bi-monthly project meetings and reviews.

IGNITION STUDIES - Ignition studies were organized to address two missions in accordance with the MFAC recommendation of July, 1984.

Initial Mission I study efforts were outlined in a kick-off meeting on September 27, 1984. Approaches to the Mission I studies of ignition experiments were presented as follows:

- FEDC will study the "spherical torus" tokamak concept by ORNL.
- GA's approach, derived from their TFCX work, will consider highly elongated plasma cross-sections operating in the "first stability" regime.
- MIT's approach will be driven by the high performance magnet/structure concepts of their "ZEPHYR" and "LITE" designs.
- PPPL will concentrate on improved plasma performance in the "second stability" regime through the use of cross-sectional shaping.

Mission I assumptions were reviewed by tokamak physicists and engineers in an ignition study workshop on November 14, 1984. Concern was expressed that Mission I should not depart from the "conventional" physics to be demonstrated by TFTR, JET and JT-60. The ORNL spherical torus and elongated plasma concepts by GA were subsequently deleted, and emphasis was placed on the establishment of engineering feasibility of a small-sized, low-cost copper device. Emphasis on maintaining costs significantly lower than TFCX limited candidate concepts to "short pulse" operation. Three alternate approaches were studied at this time by PPPL, MIT and the Ignitor/(BCX)² group, with each approach allowing several design variations.

The technical value of a short pulse ignition experiment was not universally recognized as a "necessary" step. The introduction of the International Technical Working Party (TWP) in reviewing options for a compact copper ignition experiment strongly influenced all Mission I activities. Physics guidelines were reviewed by an international meeting on March 12 and 13 at Princeton. Plans and preparations for a Design Point Workshop to be held at MIT in June were made to assure that study results would be available and would be presented in a consistent manner. Ignition physics were again reviewed at PPPL on April 3, 1985. The progress of the PPPL design was reviewed on April 4, 1985, and the MIT design on April 30, 1985. The approach to projecting experiment costs were examined on May 20, 1985. A "final" review of the material to be presented was held at PPPL on May 29, 1985. The Design Point Workshop was conducted at MIT on June 11-13, 1985, and was considered to be completely successful in its mission. Workshop results were subsequently presented to the TWP meeting in July in Tokyo, Japan, and a general endorsement of the U.S. plan was received.

Mission II study efforts were "kicked-off" at a meeting on October 22, 1984. Initial presentations suggested the pursuit of individual, innovative approaches to fully explore the potentials of new physics and relaxed engineering constraints. Subsequent meeting results and the perceived potential for international collaboration opportunities shifted ignition study emphasis toward Mission I. Mission II options offered attractive design features, but continued to be regarded as non-affordable.

COMPACT IGNITION TOKAMAK (CIT) - The concept and plans for a Compact Ignition Tokamak (CIT) experiment evolved from the Mission I Ignition Studies conducted in FY'84 and '85. Evolution of requirements and configurations continued through monthly meetings of the CIT Design Coordination Committee and the Ignition Technical Oversight Committee (ITOC). Concept selection and program definitions were formulated in early 1986. The cooperation among the team of multiple organizations, offices and individuals was commendable, and produced an impressive result.

The selected concept, a variation of the MIT LITE design, emphasized the reduction of development risks. PPPL, as the lead laboratory for the CIT experiment, submitted a Design Report and Program Proposal in May 1986. OFE/DOE reviews are being conducted to plan the future of the CIT program. Continued refinement is planned in study and design activities through FY'87.

INTOR - The initial phase of INTOR produced a design based on the consensus of the international study team to represent the "maximum reasonable step" beyond TFTR and JET. Criteria for this design were oriented to the technical performance of the device and do not include considerations of costs. This INTOR configuration is being maintained as a reference design as the next phase addresses the application of new physics and innovative approaches for tokamaks. Dr. Paul Rutherford, Dr. Charles Baker and Dr. Grant Logan assisted Dr. Stacey in developing attractive ideas through a series of laboratory visits and workshops. A workshop for screening and selection of ideas was conducted at GIT in Atlanta, Georgia, in October 1985. Selected innovations were presented at the IAEA Specialists Meeting on Tokamak Concept Innovations in January 1986. The most promising ideas will now be studied by INTOR participants for possible inclusion in the forthcoming advanced INTOR design concept.

INTERNATIONAL ETR - Guidelines and objectives regarding systems studies in support of an engineering test reactor as a potential program of international collaboration were developed in FY'86. It is assumed that an international organization will be established to develop and promote the program and that the program goal will be to produce a tokamak facility capable of fully confirming the scientific feasibility of fusion and conducting engineering tests of blanket modules relevant to the design and operation of fusion reactors. LLNL will be the lead laboratory on this program and their TIBER design concept as produced in previous ignition studies will be adopted as a low-cost, but technically relevant approach to the ETR design.

Task Area 4 - Research and Development Plan

Efforts in this task area were primarily involved in the general review of activities and plans currently in effect. TSS members have participated in formal reviews of current R&D efforts and the technical assessment of proposed R&D activities, but did not play a major role in the development of R&D plans.

Task Area 5 - Conference Support

TSS support was provided in preparing for and conducting conferences, seminars, etc. as sponsored or supported by OFE.

The Reactor Study conferences regarding Mission I of the Ignition Studies on September 27, 1984; Mission II of the Ignition Studies on October 22, 1984, and the Tokamak Power System Studies, October 23, 1984, were arranged by the TSS staff. All arrangements for the Advanced Tokamak Workshop of November 13 and 14, 1984, and the Ignition Study meeting of November 15, 1984, were made by the TSS staff.

TSS support was provided in the advance planning for the International Physics meeting held at Princeton on March 12 and 13, 1985; the International Design Point Workshop held at MIT on June 11-13 1985, and the TWP Workshop in Tokyo, Japan, on July 11-13, 1985.

Conference support was provided for the OFE fusion planning meetings of May 21, 1985, and the planning retreat of June 6 and 7, 1985. This support included securing the services of conference facilitators Mr. Roger Shaw and Mrs. Alice Sargent.

TSS support was provided in the advance planning of the US/Japanese Exchange meetings held at FEDC in August 1984 and in Japan in October 1985 and the TWP meeting at UCLA in January 1986.

Conference support was provided for the Safety Guidelines meeting that was held in Chicago, Illinois, in November 1985 and the International Engineering Test Reactor Workshop that was conducted by OFE in July 1986.

Task Area 6 - Reports

Management Plan - The initial Management Plan was submitted and approved in January 1984. The Management Plan is being revised in accordance with the decreased scope of the contract extension.

Cost Plan - A revised Cost Plan will be submitted in accordance with the decreased scope of the contract extension.

Conference Records - TSS Conferences providing OFE direction and guidance were documented through the issuance of TSS-CR83-01 thru TSS-CR86-57.

Quarterly Reports - The eleventh Quarterly Report was distributed in August 1986, upon receipt of OFE approval.

Fusion Meeting Reports (FMR) - TSS members and participants issued 128 Fusion Meeting Reports in the course of participating in and reviewing fusion meetings. FMRs documented observations and recommendations regarding fusion meetings.

Office Memorandums (OM) - TSS members and participants issued 120 Office Memorandums regarding fusion activities. OMs documented TSS work in response to specific assignments.

4. OPEN ITEMS:

There are no open items pending the start of the contract extension. All Work Task Orders of the initial contract period are considered completed as of September 30, 1986. New WTOs will be issued to cover the work of the TSS contract extension.

5. SUMMARY STATUS ASSESSMENT AND FORECAST:

Technical support has now been provided under the TSS contract for more than three years. We had proposed to provide the required support with a team of highly qualified individuals and representing a broad range of industrial interests and capabilities. We regret that budget limitations forced reductions in our staff and that all local support will now be discontinued. We are convinced, however, that TSS members and participants have equalled the promises of our proposal and through dedicated work, have made significant contributions to systems study activities and to the OFE program in general. Providing technical support in a staff capacity is walking a fine line where a strong presence will produce accusations of taking credit for or interfering with the work of others. Maintaining a low profile could invite doubts regarding capability and credibility or misrepresentations as with the assessment of MFAC Panel XIII. We are thankful for the acceptance, all the help we received and especially for the effective direction by Dr. Philip Stone and Mr. Al Opdenaker. We will always value the relationships that have been established at OFE and throughout the fusion community.

My greatest concern regarding the future of fusion is that too many community participants are competing rather than pulling together at a time when understanding and cooperation is needed more than ever. I believe that much of this could be remedied by stronger leadership and a better example within OFE. The TPA report impressively chronicles the overall picture, but no specific plan exists to show near-term activities and milestones. The absence of a specific plan promotes the image of indecision which encourages continued competition. It is fine to have MFAC comment on priorities and program values, but their inputs should be solicited in advance to help make decisions, not to question and cast doubts after the fact.

I am concerned that the pressures of a tight budget will produce low-ball estimates that eventually result in overruns or cleverly worded claims of success that are transparent in reality, but in effect constitute damaging proof of failure. Scientific discoveries certainly cannot be scheduled, but more attention has to be paid to proving that credible management exists whenever possible.

In the interests of systems studies, I am concerned by the potential threat that key individuals and organizations may not be funded simply because the value of study results is not universally respected. Special recognition should be afforded university programs that demonstrate effective student involvement to assure the availability of quality talent in the future.

The absence of a clearly defined role for industrial involvement surely discourages industrial participation. It is understandable that the major impact of budget reductions should be directed at industry, where non-essential efforts can be easily deleted. My concern is that substitutes for established industrial participants will produce inefficiencies and compound many of the difficulties that have previously been mentioned.

A specific result of TSS reductions is the reassignment of senior professional personnel representing more than 60 years of unique experience regarding fusion programs and studies. It is not clear that these individuals will be available, or will be needed at some time in the future. Personally speaking, on both counts, I sincerely hope so.

Donald J Moyer

D. L. Moyer
TSS Manager

E. P. Fields *Dmoyer*

E. P. Fields
TSS Contract Administrator

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