INTRODUCTION

This decision deals with a protest by Lockheed Propulsion Company against the selection by the National Aeronautics and Space Administration (nasa) of thiokol corporation for final negotiations leading to the award of a contract for the solid rocket motor (srm) project of the space shuttle program.

In accordance with nasa's established procedures, on june 15, 1973, the associate administrator for manned space flight designated a source evaluation board (seb) for the srm project for the purpose of establishing evaluation criteria, preparing the request for proposals, evaluating proposals, conducting written and oral discussions, submitting a written report, reporting its findings and making an accompanying oral presentation to the administrator in his capacity as the source selection official (sso). on november 20, 1973, the administrator of nasa, with the concurrence of the deputy administrator, and the associate administrator for organization and management, selected thiokol corporation.

the space shuttle system consists of a reusable, orbiter vehicle, an external oxygen/hydrogen/tank and reusable twin solid rocket boosters of which the solid rocket motor is the major portion. the orbiter will be boosted into space through the simultaneous operation of two solid propellant motors and three high pressure liquid oxygen/hydrogen main engines loc ted in the rear of the orbiter. the booster solid rocket motors will burn in parallel with the orbiter main engines during lift off and initial flight. the boosters will then be separated from the external tank for earth landing by parachutes for recovery and reuse. just prior to achieving orbital velocity, the main engines will be shut down and the external tank jettisoned with the orbiter then proceeding into its orbital track.

each srm is composed of the following major components: a case, solid propellant, insulation, liner, and maneuverable or flexible nozzle.

the srm, when recovered after launch, will be transported to the contractor's facility for refurbishment, refueling and reuse. the process will reduce substantially the cost of space operations through the continuous reuse of a limited amount of hardware.

this procurement for phase c/d of the srm program followed the performance of four parallel phase b study contracts for srm motor definition. these contracts were awarded to thiokol corporation, lockheed propulsion company, aerojet solid propulsion company, and united technology center. because of the research and development nature of the space shuttle program and the degree of programmatic uncertainty involved, nasa decided to award a cost-plus-award-fee contract.

request for proposals

the request for proposals (rfp no. 8-1-4-94-98401) was issued for a cost- plus-award-fee contract to be negotiated under the authority of 10 u.s.c. 2304(a)(11) which permits the negotiation of contracts for research and developmental work. the contemplated contract is for the design, development, test, production, acceptance, operation and refurbishment of the srm and its ancillary equipment, post-flight analysis and support functions.

the rfp, as amended, emphasized that the design and manufacture of the srm was to be devised so as to insure the high reliability of the finished product. moreover, since the srm is the largest element in computing total cost per flight, the rfp provided that "\*\*\* design to cost for every item and operation is a critical aspect of the srm project." the rfp further emphasized the unique aspects of refurbishment and reuse and the fact that these processes must also be cost-effective.

each proposer was required to submit a proposal encompassing the entire srm project for three increments. cost proposals were requested for increments 1 and 2 which covered all efforts required for the total design, development, test and evaluation (ddt&e) of the srm, including six developmental flights, and all efforts necessary to manufacture, test, and deliver new and refurbished srm's for 54 flights (108 srm's). increment 3 cost estimates were to comprise all efforts necessary to manufacture, test, and deliver new and refurbished srm's for 385 flights (770 srm's).

however, the rfp further stated that:

\*\*\* for contracting purposes, the government intends to procure the total ddt&e, that is, increment 1 as the initial contract coverage. the government, at its option, may negotiate for increment 2 and adjust the time and/or quantities for the second and third increments. the government contemplates a separate procurement for increment 3.

the first 2 increments encompassed the years 1973-1981, and the third increment 1981-1988. all cost details were to be displayed in calendar year 1972 dollars ($72) and real year dollars ($ry), the latter defined as those dollars expected to be expended in the performance of the program or calendar year 1972 dollars adjusted for escalation.

the rfp established the following evaluation factors: mission suitability, cost, and other factors. the factors to be evaluated by the seb with their respective criteria and relative importance are quoted below:

mission suitability factors

2.2.1 mission suitability factors are those factors which will be employed to evaluate the quality of work or product that is offered, the ability of the proposer to actually produce what is offered, and the applicability of the total concept of the mission. proposals will be evaluated and scored according to the criteria set forth herein. the evaluation of the work or product offered will deal primarily with what the proposer will do to meet the established requirements and why he proposes his approach as the best approach.

2.2.2 the rating of proposers under the mission suitability factors will be substantially determined by the extent to which the proposed approaches are expected to contribute to low production and low operating costs. predicated upon proposed ddt&e efforts at reasonable levels of cost, risk, and technical adequacy, the proposer's scores under mission suitability factors will be related to the government's projection of his solid rocket motor proposal's impact on space shuttle system cost per flight.

2.2.3 the mission suitability factors are:

factor 1 - manufacturing, refurbishment, and product support

factor 2 - design, development, and verification

factor 3 - management

2.2.3.1 criteria

for purposes of evaluation, criteria have been established under each mission suitability factor as follows:

factor 1: manufacturing, refurbishment, and product support

criterion 1: manufacturing, safety, and product assurance. evaluated under this criterion will be the proposer's planning, innovation, and technical excellence in producing high quality, low cost srm's. this includes manufacturing and tooling approach, efficiency, safety, and rate flexibility.

criterion 2: refurbishment and product support. evaluated under this criterion will be the proposer's planning, innovation and technical excellence in achieving low project risk with consideration of such areas as adequacy and effectivity of facilities to support the work as proposed, cost-effective refurbishment, logistics, transportation, handling, support equipment, and launch site operations and support.

factor 2: design, development and verification

criterion 1: solid rocket motor design. evaluated under this criterion will be the proposer's innovation and technical excellence in achieving a minimum development risk and highly reliable design at a reasonable ddt&e cost which will provide reusability, refurbishability, and low cost production and operations, including its influence on facilities, handling and transportation, as well as the achievement of performance requirements.

criterion 2: solid rocket motor development and verification. evaluated under this criterion will be the proposer's innovation and technical excellence in achieving a cost-effective development, test and verification program that minimizes risk and early year funding requirements.

factor 3: management

criterion 1: management approach and organization. evaluated under this criterion will be the proposer's management effectiveness in achieving project goals and requirements, the overall logic, approach and organization selected for this procurement, and methods for management control and integration.

criterion 2: key personnel. evaluated under this criterion will be the qualifications and experience of key personnel as related to their proposed assignments and their demonstrated capability to achieve effective and economical management.

2.2.3.2 relative importance of criteria

for evaluation purposes, the relative importance of the criteria is as follows:

most important

manufacturing, safety and product assurance

refurbishment and product support

srm design

management approach and organization

very important

key personnel

srm development and verification

the most important are of equal value, and the very important are of equal value and are significantly less in value than the most important.

2.3cost factors

2.3.1 cost factors are those factors which indicate the adequacy and realism of the cost proposal and the probable costs that will be incurred. the evaluation of cost factors will include an assessment of the cost of doing business with each proposer and the possible growth in proposed costs during the course of the program. it will also include a comparison with nasa's estimates of the probable development cost, as well as the probable cost per flight.

2.3.2 cost factors as such will not be numerically scored by the seb. they will be reported by the seb to the source selection official. the importance of cost factors in the selection will depend on such considerations as the magnitude of the cost differentials between the proposers, the credibility of such differentials, the keenness of the competition in mission suitability factors, and the impact (if any) of other factors.

2.3.3 cost relationship to mission suitability factors. the cost proposal will be used extensively in the government's evaluation and scoring of mission suitability factors to determine realism, understanding of requirements, and whether the design and production approach being taken will lead to the lowest production and operational cost consistent with reasonable development cost.

2.4 other factors

2.4.1 factors in this grouping are those which have not been included in either the "mission suitability" or "cost" grouping but which will be considered by the source selection official in making his selection. their nature does not permit a meaningful numerical pre determination of relative significance or impact on the selection decision; they are not, therefore, numerically scored by the seb.

2.4.2 the other factors listed below have been identified as being such that they bear on a proposer's ability to meet the requirements and objectives of this procurement and will be considered by the source selection official:

a. financial capability. a proposer's financial capability to properly execute a program of this type and magnitude.

b. past performance. a proposer's performance on prior and current programs for the government.

c. related experience. a proposer's related experience on relevant, prior, or current programs. d. utilization of small business. proposer's plans to utilize small business enterprises as subcontractors or suppliers.

e. utilization of minority owned enterprises. a proposer's plans to utilize minority owned enterprises as subcontractors or suppliers.

f. proposed contract. the acceptability of the proposed contract.

g. proposed fee structure. a proposer's plan or arrangements made with regard to base and award fee.

h. facilities. flexibility inherent in the proposed facilities plan and its adaptability to nasa's plan to separately contract for increment 3.

2.4.3 the foregoing do not constitute an all-inclusive listing of other factors which may be considered in the selection decision. if important additional factors evolve or surface during the source evaluation and selection process which also bear upon a proposer's ability to meet the requirements and objectives of this procurement, they, too, will be given appropriate consideration.

in addition, the rfp's introduction provided:

4.4 facilities policy

the general policy of the national aeronautics and space administration is that contractors will furnish those facilities that are required for the performance of government research and development contracts. nevertheless, the proposer should select the facility approach considered the most efficient from a cost standpoint and may propose existing or new contractor or government facilities in any combination. it is expected that existing facilities will be utilized as long as they are cost- effective.

seb evaluation plan

as established by the source evaluation plan developed by the seb, the evaluation effort was divided into four primary areas each corresponding to either a mission suitability or cost factor. a designated team undertook the detailed evaluation in each of these areas. the four teams, each chaired by an seb voting member were the cost team, design, development and verification team, management team, and manufacturing, refurbishment and product support team.

individual team members were advised to note that the rfp had stressed the importance of economic considerations in this procurement. just as the proposers were being requested to "design to cost," the evaluators were advised to "evaluate to cost." each evaluator was to examine the resource estimates for his respective area and ascertain the validity of the estimates. where changes were warranted, the evaluator would recommend adjustments.

the teams were further broken down into panels, each dealing with an area within the team's topical area. moreover, each panel was similarly divided into subpanels. subpanel chairmen had to assess proposal material specifically related to their subpanels and also to review and consolidate the information provided by the subpanel evaluators. each subpanel made at least one direct oral report to the seb. the panel chairmen in consultation with subpanel chairmen consolidated the findings of each subpanel and submitted this material to the team chairmen who, in turn, were responsible for reviewing and consolidating the panel findings and assigning one of the following adjective ratings for each criterion:

excellent, very good, good, fair, poor

in addition to pointing out strengths, it was the function of the design team to ferret out design weaknesses, to propose programs or methods to correct the weaknesses, and refer them to the manufacturing team to estimate manhours and materials required to correct the weaknesses. this input was then given to the cost team to apply labor rates, overhead, material costs, and escalation factors as required. the cost team presented the end result of the proposed adjustment to the seb for approval. if the adjustment was approved, it was integrated into the proposer's cost tabulation.

the foregoing approach to design evaluation comports with nasa procurement regulation directive (prd) no. 70-15 (revised) which states in part that:

the (seb) report should state also the board's estimate of the approximate impact on cost or price that will result from the elimination of correctible weaknesses during negotiations after selection.

\*\*\* where the meaning of a proposal is clear, and where the board has enough information to assess its validity, and the proposal contains a weakness which is inherent in a proposer's management, engineering, or scientific judgment, or is the result of its own lack of competence or inventiveness in preparing its proposal, the contracting officer shall not point out the weaknesses. discussions are useful in ascertaining the presence or absence of strengths and weaknesses. the possibility that such discussions may lead an offeror to discover that it has a weakness is not a reason for failing to inquire into a matter where the meaning is not clear or where insufficient information is available, since the understanding of the meaning and validity of the proposed approaches, solutions, and cost estimates is essential to a sound selection. proposers should not be informed of the relative strengths or weaknesses of their proposals in relation to those of other proposers. to do so would be contrary to other regulations which prohibit the use of "auction techniques." in the course of discussions, government participants should be careful not to transmit information which could give leads to one proposer as to how its proposal may be improved or which could reveal a competitor's ideas.

the other teams evaluating mission suitability factors functioned in essentially similar manners although the individual areas within which they concentrated did not necessarily lend themselves to the same treatment afforded to design. the cost team was charged with performing a comprehensive analysis of the proposed costs in accordance with the rfp evaluation factors.

the teams reported their detailed findings to the seb. essentially, teams were to act as fact-finding arms of the seb. the seb did not, however, delegate its evaluation responsibility either in whole or in part, since the team reports were carefully reviewed and the seb applied its own collective judgments to the team findings. no scoring was recognized below the seb level.

each seb member independently gave a percentile score for each proposer for each mission suitability criterion. these scores were then averaged by criteria and a consensual score arrived at by the seb after discussion. the consensus value in percent was multiplied by the points allocated to the respective criterion. this established the board score for each mission suitability criterion for each proposal.

chronology of procurement and selection

the rfp was issued on july 16, 1973, to four prospective sources - thiokol, lockheed, utc, and aerojet. technical and cost proposals were submitted on august 27 and 30, 1973, respectively, by the four firms. from the latter date until october 20, 1973, the seb, according to the source evaluation plan, evaluated and scored the proposals and established preliminary rankings for the offerors. during the period from september 24 through october 10, 1973, oral and written discussions were conducted with all of the offerors. all offerors filed timely best and final offers by the cut-off date of october 15, 1973. after the cut-off date, final reports of the seb's evaluation teams were submitted to the seb.

the four proposers were ranked and scored in mission suitability as follows:

score overall adjective rating

lockheed714 very good

thiokol 710 very good

utc 710 very good

aerojet 655 good

the seb was of the opinion that all proposers had the requisite capability and experience to accomplish the srm project. furthermore, the seb evaluated thiokol as the lowest most probable cost performer by $122 million ($ry) with lockheed evaluated second lowest. both proposers estimated total program cost to be in the $800 million ($ry) range. the seb compiled a report of its findings which was presented to the sso and was the basis of its oral presentation to the sso on november 19, 1973. the sso, after selecting thiokol for final negotiations, issued a selection statement on december 12, 1973, which states, in pertinent part, as follows:

in considering the results of the board's evaluation, we first noted that in mission suitability scoring the summation resulted essentially in a stand-off amongst the top three scorers (lockheed, thiokol and utc) though with a varying mix of advantages and disadvantages contributing to the total. within this group, lockheed's main strengths were in the technical categories of scoring, while they trailed in the management areas. thiokol led in the management areas but trailed in the technical areas, and utc fell generally between these two. we noted that aerojet ranked significantly lower than the other three competitors in the mission suitability evaluation, and the proposal offered no cost advantages in relation to the higher ranked firms. accordingly, we agreed that aerojet should no longer be considered in contention for selection.

we noted that the board's analysis of cost factors indicated that thiokol could do a more economical job than any of the other proposers in both the development and the production phases of the program; and that, accordingly, the cost per flight to be expected from a thiokol built motor would be the lowest. we agreed with the board's conclusion that this would be the case. we noted also that a choice of thiokol would give the agency the lowest level of funding requirements for srm work not only in an overall sense but also in the first few years of the program. we, therefore, concluded that any selection other than thiokol would give rise to an additional cost of appreciable size.

we noted that within the project logic and the cost proposals, there was a substantial difference in basic approach caused by the varying amount of new facilities needed by the several proposers. their situations ranged from thiokol, who needed little new facilities investment to do the job, to lockheed, who proposed creation of a new facility complex on the gulf coast to handle the program, commencing at an early date and building up to full size by the production phase. the prospect of such a major new facility raises a question regarding the basic operational economics involved, and also a question of what other important benefits or drawbacks there might be to such a plan. in regard to the economics proper, the board's evaluation made it clear that such an investment could not at this time, under any reasonable view of the forecasted economic factors, be considered likely to pay its way as against thiokol's existing facility. as regards other considerations, we recognized that it may well be advantageous, when the major production phase arrives, to plan to have two or more suppliers in the country capable of competing for the manufacture of srm's in quantity; however, there is no need to embark upon the construction of a new major facility at this time in order to secure these benefits in a timely manner.

we found no other factors bearing upon the selection that ranked in weight with the foregoing.

we reviewed the mission suitability factors in the light of our judgment that cost favored thiokol. we concluded that the main criticisms of the thiokol proposal in the mission suitability evaluation were technical in nature, were readily correctable, and the cost to correct did not negate the sizeable thiokol cost advantage. accordingly, we selected thiokol for final negotiations.

award of the contract has been withheld pending resolution of this protest.

chronology of protest

lockheed filed notices of protest by letters dated december 5, 6, and 14, 1973. on january 9 and 21, 1974, lockheed furnished protest details which were forwarded promptly to nasa requesting a complete report responsive to the protest. by this time, thiokol, utc, and aerojet had expressed active interest in the protest. on or about february 15, nasa awarded a 90-day interim contract to thiokol for studies, analysis, planning and design in support of the integration of the srm into the space shuttle system. lockheed protested the award of the interim contract shortly thereafter. nasa filed a report, through the assistant administrator for procurement, on march 11, 1974. the report was distributed to all interested parties for comment.

the report revealed to the protester and interested parties previously unknown significant cost information and other evaluation details upon which the selection of thiokol was based. prior to this, lockheed had been unsuccessful in obtaining such information from nasa. lockheed filed extensive comments on the nasa report on april 9, 1974, wherein, for the first time, specific contentions based on the previously unavailable significant cost information and other details were made. on april 23, a bid protest conference was held at gao attended by all interested parties and nasa. the formal record was then closed except for possible questions gao might have to ask of lockheed, thiokol, and nasa. on may 8, questions were posed to lockheed, thiokol and nasa, all of whom responded to gao by the may 15 deadline. about that time, lockheed protested any possible extension by nasa of the interim contract to thiokol. nasa extended the interim contract for 45 days or until approximately july 1. on may 20, further questions were raised with nasa by gao. a response was received on may 24 and lockheed filed comments thereon on may 30, 1974.

**decision**

this decision was reached after a thorough and comprehensive review of the voluminous documentation submitted by lockheed, thiokol and nasa, as well as presentations made at the bid protest conference. to assist in the resolution of the many issues raised by the protest, gao assembled an audit team at the marshall space flight center where the procurement file is located. nasa's workpapers and other material were reviewed by the gao team. from shortly after the protest was filed, the gao review was performed at the center simultaneously with the procedural steps in the bid protest process. site visits were made to lockheed and thiokol. while, in the interest of clarity of presentation, this decision does not respond specifically to each matter brought to our attention, we thoroughly considered all available information and documentation.

the lockheed protest charges that the entire nasa evaluation was marred by plain mistakes, inconsistency, arbitrary judgments, and improper procedures. lockheed states an adequate and proper cost evaluation would have resulted in its proposal being evaluated low by an amount significantly in excess of $100 million and conceivably in excess of $200 million. furthermore, lockheed argues that it was prejudiced by improper correction in thiokol's design, improper crediting of thiokol proposal features not conforming to the rfp, improper reliance on uncertain cost estimates, and improper disregard of future competition as a factor. the effect of these alleged prejudicial occurrences in combination with the alleged improprieties in the evaluation of cost made the selection of thiokol improper, and is said to have wrongfully denied lockheed the ward of the srm contract.

on the other hand, nasa vigorously defends the selection of thiokol as the lowest cost proposer citing a most probable cost difference of $122 million ($ry) which "must be regarded by nasa as the potential savings attainable by contracting with thiokol." nasa maintains that the seb evaluation as adopted by the sso properly concluded that both thiokol and lockheed were essentially equal in the mission suitability scoring and "other factors" evaluation.

gao's examination and review revealed no reasonable basis to question the sso's decision based on scored mission suitability and unscored "other factors" evaluations. nor did the review find that the reliance on cost represented an unreasonable exercise of discretion. however, as set forth in more detail below, we recommend that the sso determine whether, in light of the gao findings that the most probable cost differences between lockheed and thiokol were significantly less than those reported by the seb and relied upon by the sso, the selection decision should be reconsidered.

before proceeding with a discussion of the issues, it is noted that a substantial amount of information and documents furnished gao with the nasa report of march 11 and in its answers to gao questions of may 8 were withheld from the protester and interested parties at the request of nasa. according to nasa, that material contains business confidential material and descriptions of confidential proprietary manufacturing processes, the disclosure of which would be in violation of law. also not released to the protester and interested parties were seb analyses of probable cost based on the proposals submitted to be further used by nasa in the negotiation of the srm contract and material generated prior to final negotiations. in addition, while nasa has publicly released the significant evaluated cost differences where the seb made adjustments to proposed costs between thiokol and lockheed, the specific amounts of the adjustments have not been released except in rare instances.

the discussions of the protest issues that follow are presented in a context which safeguards the confidential or proprietary aspects of the data.

cost evaluation

lockheed contends that a proper evaluation of proposals must result in the conclusion that the lockheed proposal would result in substantially lower probable cost by an amount significantly in excess of $100 million and conceivably exceeding $200 million rather than the $122 million most probable cost difference in favor of thiokol reported by the seb to the sso. the seb's cost evaluation, it is claimed, contains mistakes, inconsistent and unfair comparisons, omissions of necessary costs, and a failure to assess cost realism. with respect to cost realism, inter alia, lockheed maintains the seb improperly left unquestioned and unadjusted between the two proposals a $73 million difference in the estimated cost of purchasing ammonium perchlorate (ap) when the material is to be purchased from the same suppliers in the same quantities. also, the seb is said to have left an unjustified difference in the projected escalation of 1972 dollars to real year dollars amounting to a $60 million prejudice. by allowing these differentials to remain, which reflected widely varying estimates of common cost items, lockheed alleges that nasa abandoned cost realism, negating the value of cost comparisons which ultimately became determinative.

gao has reviewed and examined all the major cost areas lockheed claims were improperly evaluated by the seb and relied upon by the sso. we found the seb evaluation to have been reasonable except for its evaluation of ammonium perchlorate. any disagreements we may have in specific cost areas do not obviate the overall reasonableness of the seb evaluation; in any event, the disagreements have only a minimal effect on the overall cost picture.

in its evaluation, the seb adjusted proposed costs to reflect the dollars necessary to correct for weaknesses, omissions, errors, and over-or under- estimates. adjustments were made only when, according to nasa, the basis for the adjustment could be substantiated and all members of the seb agreed. in addition, the seb conducted an analysis of cost uncertainty with respect to each proposal. within the adjustment process, the seb normalized certain costs. that evaluation exercise is performed when at least two proposers are measured against the same cost standard either because there was no logical reason for differences or insufficient information was provided with the proposals so that common "should have bid" estimates had to be established.

ammonium perchlorate

all proposers offered a propellant formulation comprised largely of ammonium perchlorate (ap), which is currently manufactured in the united states by only two sources - kerr-mcgee chemical corporation and pacific engineering & products company of nevada (pepcon). all proposers recognized that the current combined capacity of the kerr mcgee and pepcon plants, both located at henderson, nevada, would be insufficient to supply ap for the srm and non-srm programs and still provide an acceptable additional capacity, especially during increment 3 (1981-1988). determine the amount of additional production capacity which would be required, the proposers estimated (1) capacity of the existing plants, (2) amount of ap required for the srm program, and (3) amount of ap required for all other programs.

although both lockheed and thiokol worked closely with the known ap suppliers, lockheed's proposed ap costs were $76 million more in real year dollars than the costs proposed by thiokol. most of the difference was in increments 2 and 3 where 98 percent of the ap will be used. although there were differences in the proposers' estimates of current ap plant capacity and the amount of ap required for the srm program, the greatest difference was apparent in the estimates of ap required for other programs.

lockheed's propellant formulation requires about one percent more ap than thiokol's which accounts for differences in the estimates of srm program ap requirements. in addition, lockheed estimated current ap plant capacity at about 38 percent less than thiokol. the lockheed estimate was based on a letter from kerr-mcgee, currently the largest ap supplier.

with respect to the anticipated demand for non-srm programs, lockheed projected a continuation of the current 12,000 tons a year demand throughout the life of the srm program. in sharp contrast, thiokol projected substantially lower non-srm demand (about 2,500 tons a year) during the peak program years. the seb independent study concluded that non-srm demand would materialize at about the level predicted by thiokol. aerojet and utc also projected the non-srm demand at about this same level.

to meet the total ap needs, lockheed proposed that kerr-mcgee build a new ap plant in the gulf coast area which would be dedicated essentially to the srm program needs. non-srm requirements and any excess capacity would be met from the existing nevada plants. lockheed selected the gulf coast location because of the availability of lower cost raw materials, electrical power, labor, and decreased transportation costs to lockheed's proposed gulf coast production site. the cost of the new plant was estimated at about $44 million ($ry) and would be amortized into the price of the ap. thiokol proposed only a moderate expansion of the current nevada plants at a cost of about $10.645 million ($ry). this cost would also be amortized into the ap prices.

data contained in the lockheed proposal clearly showed that the decision to build a large new ap facility resulted primarily from lockheed's high estimate of non-srm program demand. nasa characterized the influence of non-srm demand on lockheed's decision as speculative and at best uncertain because lockheed chose a new, essentially dedicated site, even though by the firm's own estimates substantial excess ap capacity would result. believe, however, that the seb misinterpreted lockheed's proposal since the excess ap capacity remaining in both lockheed's and thiokol's proposals is almost exactly the same after subtracting out srm and non-srm requirements. in addition, lockheed's response to an seb question made clear that the size of the proposed ap facility would be reduced if the non-srm demand decreased. this further illustrates the relationship between the proposed facility and the non-srm demand projection.

lockheed contends that nasa should have provided a government estimate of the expected non-srm demand in the rfp. having failed to do so, lockheed claims nasa should have normalized the proposed ap prices. lockheed also believes its most probable cost was prejudiced because nasa made an adjustment for ap cross-blending when this cost was already included in the proposed ap prices.

the seb did not evaluate or normalize proposers to a common cost per pound because, in its view, normalization would destroy a unique feature of the lockheed proposal - the ap siting decision. according to nasa, directly or indirectly restructuring a proposal by altering the basic siting decision would be presumptuous and unfair and would, in effect, dictate the f.o.b. manufacturing site. nasa stated that power, raw material, and capitalization costs are dependent on the plant location and valid real differences could reasonably be expected in the ap prices. according to nasa, normalization of the ap prices would have broken its basic ground rules for normalization by altering the uniqueness of a proposal and eliminating a valid cost discriminator.

we found the nasa arguments to be without foundation. in our view, the rfp should have apprised offerors of the government's estimate for non-srm demand since demand would materialize at the same level for any srm contractor. because proposers were required to project the non-srm demand, lockheed was forced into a situation where its prediction influenced a proposal approach which resulted in substantially higher facility expense.

in the absence of a standardized rfp estimate of non-srm demand, the seb should have normalized the proposed ap prices. based on the gao review, any proposer selected to perform the srm contract would obtain ap from the same sources and the ap subcontractor would expand or construct new facilities only as needed. if lockheed were awarded the contract and the non-srm demand did not materialize at the projected level, nasa, with its contractual control over subcontracts, probably would not authorize construction of a new plant if moderate expansion of existing facilities would satisfy srm needs at a substantially lower cost. the failure to compute and apply a common cost per pound for ap was unreasonable.

differences in the proposed ap prices were magnified by the application of different escalation factors by the two proposers. although it is not unreasonable to expect different escalation factors among the proposers (see discussion below), escalation of the ap prices should have been normalized by the seb since proposers would be buying essentially the same quantities from the same sources at the same locations. because srm requirements will dominate the ap market in the peak years, any discounts available will go to the srm contractor whoever that may be.

to eliminate an unreasonable penalty in lockheed's most probable cost, gao has normalized lockheed's proposed ap prices to the prices proposed by thiokol. as a result of normalization, lockheed's cost would be reduced by about $22 million ($72) and approximately $73 million ($ry). because of the ap price normalization, however, lockheed would obtain ap from nevada rather than the gulf coast area and therefore would incur higher transportation costs. using lockheed's estimate of transportation costs from nevada to the gulf coast area, gao computed this additional cost as about $5.430 million ($72) and $6.254 million ($ry).

gao also reviewed lockheed's claim that its most probable cost was prejudiced by the nasa adjustment for ap cross-blending. the review showed that cross-blending costs were included in lockheed's proposed ap prices and, therefore, the seb adjustment should be eliminated. the adjustment for cross-blending totaled $2.784 million ($72) and $4.029 million ($ry). we noted, however, that when ap prices are normalized the lockheed cost does not include the cost of grinding ap. lockheed proposed that ap be ground at its subcontractor's plant while thiokol proposed grinding ap at its plant. for safety reasons, the seb determined that ap cannot be ground at the subcontractor's plant but for evaluation purposes did not adjust lockheed's cost because the grinding costs were included in the ap prices. however, when normalized to the thiokol proposed ap prices, grinding costs are not included. ap grinding costs, as proposed by lockheed, would total $2.271 million ($72) and $3.305 million ($ry).

in summary, the result of our normalizing ap prices is a reduction in lockheed's most probable cost of about $17 million ($72) and $68 million ($ry). the $51 million difference is attributable to our normalization of escalation. in our view, lockheed's probable costs should have been evaluated by the seb on this basis.

escalation

the rfp requested proposals for the entire srm project and provided for evaluation based on the entire project rather than any particular segment or increment. cost factors to be evaluated were defined as "those factors which indicate the adequacy and realism of the cost proposals and probable costs that will be incurred. the evaluation of cost factors will include an assessment of the cost of doing business with each proposer and the possible growth in proposed costs during the course of the program." the rfp stated:

all cost details and substantiation data shall be displayed in calendar year 1972 and real year dollars as specified in the applicable section. real year dollars are defined as those dollars expected to be expended in the performance of this program; that is, calendar year 1972 dollars adjusted for escalation. escalation are those changes to calendar year 1972 dollars caused by such things as inflation, union agreements, merit increases, increased material cost, changes in the business base, etc. accompanying methodology and rationale shall be provided for conversion from calendar year 1972 to real year dollars as well as the proposer's definition of calendar year 1972 dollars.

based on the initial proposals, about one-half of the $122 million ($ry) difference in most probable costs between the two proposers would be eliminated if the varying escalation rates (except for ap escalation discussed above and transportation escalation discussed below) used to convert 1972 dollars to real year dollars were normalized. lockheed claims that the different escalation rates introduced uncontrollable factors into the competition since escalation rates are virtually independent of the contractor selected. normalization of escalation within the various cost elements, lockheed contends, would provide a valid means for comparison between the two proposers. in the alternative, lockheed states that, since future escalation is an unknown, the seb should have used the proposed 1972 dollar costs as the basis for evaluation. in support of its argument, lockheed cites the following passage from the nathan report - a nasa-funded study on evaluating cost proposals for the srm:

where there is no clear evidence or reasons for using different rates of price increase for different proposers, it may be best to use the same rate (or set of rates) for each proposer to avoid giving an unfair advantage to proposers who submit or propose costs based on lower rates of increase than do the others.

in rebuttal, nasa points to the definition of escalation in the rfp, which, it is alleged, introduced unique and valid competitive differences which are based on variables resulting from dissimilar company policies. in addition to the factors noted in the rfp, at the bid protest conference nasa referred to other variables resulting from dissimilar company policies, such as changes in the structure of the labor force (skill mix changes, retirement rate, etc.), influence of quantity buys, method used to construct the 1972 dollar bases, and anticipated performance of subcontractors.

at the bid protest conference, nasa also said that some components of escalation are general and therefore subject to normalization, noting that inflation for labor rates was normalized to 5-percent by the seb. furthermore, in response to a later question concerning normalization, nasa stated:

re-estimating of the labor cost utilizing an effective 5% inflation resulted in a cost adjustment for thiokol since it had proposed 2.5%. however, since lockheed stated it had used 5% (nasa could not confirm this) the magnitude of any adjustment resulting from the nasa application of an effective 5% inflation is indeterminable. justification: since inflation is recognized as the "fictitious variable" element of escalation, the (nathan report) advice of recognizing an inflation value in the 4-5% range rather than 3% or less was undertaken.

from the above nasa recognizes, and we have no basis to disagree, that the inflation element of escalation should not differ between proposers. in this regard, inflation can be considered as a persistent and appreciable rise in the general level or average of prices for both labor and materials.

the nasa report and contemporaneous seb documents in the labor rate area refer only to increasing escalation rates, rather than to inflation rates. furthermore, nasa in answer to the gao normalization question stated:

thiokol's inflation rate was increased to 5%, plus additional support requirements were added to the section 22 quotations for increments i and ii rail transportation of the srm to and from the launch sites resulting in an increase of $\*\*\* (real year). justification: normalization for inflation and added support requirements was necessary due to the higher anticipated inflation in the section 22 rail rates and a need for increased support compatible with previous rocket programs (i.e., titan).

as with labor rates, escalation only, rather than inflation, is mentioned in the nasa report and contemporaneous seb documents.

the inflation element of escalation is not within the control of the individual proposers. gao examined the proposals of lockheed and thiokol, and asked specific questions relative to which elements of escalation, if any, were uniquely within their respective controls. gao's analysis disclosed that various factors which comprised the escalation rates of the two proposers reflected company policies in areas where individual controls could be exercised. in this regard, the seb asked both proposers to summarize the rationale for the escalation rates used in preparing their respective proposals and their positions if the low escalation proposed did not materialize. lockheed responded, in part, as follows:

while projections of future events which are principally determined by national (or even international) socioeconomic trends is certainly not as exact as say, a direct labor progress curve, we believe the 1973 forward projections are a reasonable "middle of the road" projection from the available back sight and current conditions.

although the labor rates and unit material values steadily increase by reason of escalation, they are more than offset by effect of learning curves, production rate, labor classification mix, material usage reduction and such other factors.

reference to the figures indicates that they appear to be reasonable extensions from recent history. whatever the actuals incurred in the future may be on an area or national basis, we certainly have, and fully accept the responsibility to mitigate their impact on this project. this we can do, principally by:

a. hard bargaining on our labor and material contracts

b. buying the minimum amount of material required to do the job, and employing the minimum personnel required to perform the task

c. firm and fair wage and salary administration, avoiding general increases in favor of awarding merit increases to demonstrated performers.

if future events beyond either our or nasa's control cause significant cost detrimental departure from the projections we have used, it is beyond the power of lpc, or any industrial contractor, to exercise meaningful control.

thiokol answered as follows:

in light of the above, thiokol believes that the escalation factors selected and used in our proposal will be achieved based upon our past experience. in summary, we have granted average merit increases and promotions in each year of operation, but we have managed to minimize the escalation effect by intelligent management of the labor force mix. have used turnover, retirements, and new hires to effect promotion from within to the maximum, and have made replacements at the low end of the labor range. we have managed our subcontractors so that their escalation was offset by competition, negotiation, and learning. we have always taken advantage of the most cost effective transportation mode. we will continue to do all of these things in the future.

our proposal is based upon our best judgment after reviewing the history available to us and evaluating the economic factors which will bear on the problem in the future. we have demonstrated our management ability to reduce cost in both declining and increasing periods of business and we will continue to control costs during the period of the srm project.

these answers and other responses highlight the difficulty the gao experienced in attempting to ascertain exactly what portions of escalation were uniquely within the control of the respective proposers. in its answer to gao, lockheed takes the position that its plan offers unique escalation control benefits over another proposer and that a small percentage of its escalation rates reflects factors known, firmly established, and uniquely controllable by lockheed. thiokol appears to relate more of its elements of escalation to unique company-controllable factors. subjective judgment played a significant role in how each proposer arrived at its respective escalation rates.

the seb did not consider escalation to be the same as inflation at least with respect to labor rates and transportation. the gao review of contemporaneous seb documents shows that several elements other than inflation were used to arrive at adjusted and escalated transportation and labor rates. for example, in labor rates, the seb examined not only inflation, but skill mixes and employment variations.

furthermore, from our review of the proposals we agree with nasa that lockheed and thiokol not only utilized different escalation rates which reflected in some measure factors that were company unique, but also constructed the 1972 dollar bases, to which escalation rates were applied, dissimilarly. we concur with nasa's representation at the bid protest conference that an example of this dissimilarity was thiokol's constant 1972 dollar labor rates and lockheed's deescalated 1972 dollar labor rates for all program years. inclusion of different variables in deriving 1972 dollar labor rates made questionable the normalization of escalation of the 1972 labor rates. in addition, normalization of escalation, at least with respect to labor rates, from these different 1972 dollar bases may have unfairly increased the cost of the proposer having a high 1972 dollar labor rate base.

from the foregoing, we conclude that escalation was a significant factor in the estimated costs under each proposal. as noted, escalation differences on elements other than ap and transportation could account for about half of the difference the seb found between the two contending proposals. escalation includes inflation, which is outside the control of the proposer, and other factors which are to a greater or lesser extent within the proposer's control. we believe it would have been preferable for the rfp to provide common inflation rates for use by all proposers. however, as required by the rfp, proposers included escalation rates in their cost proposals. in order to normalize inflation, it would be necessary to remove controllable factors from the proposed escalation rates. because of the requirements of the rfp relating to escalation, this has not been done by either lockheed or thiokol; nor are we convinced that it is possible to do so on the basis of the information submitted in the cost proposals. given these conditions, the seb's failure to normalize escalation was not unreasonable. if the procurement was being offered for competition at this time, it would be desirable to call for proposers to submit refined cost data, which includes all controllable factors in 1972 dollars, and applying common inflation rates in converting to the real year dollars. however, any attempt to obtain refined cost data would result in a restructuring of the cost proposals; in addition, cost data is inherently tied to technical proposals. therefore, we believe it would be inappropriate to permit after-the-fact restructuring. in so concluding, we recognized that our finding that the proposed ap material prices should have been normalized, resulted in a normalization of the differing escalation factors used by the proposers. our calculations there are not affected by the 1972 dollar bases. uncovered no other situation similar to ap where the proposers would predictably have to purchase essentially the same quantities, from the same sources under the same relationships, at the same location, at the same price, for purchase in the same periods of time.

facility costs lockheed contends that its actual facility costs to perform the contract are nearly the same as thiokol's and computes the difference as approximately $17 million ($ry) in favor of thiokol. on the other hand, the seb found that the difference between the two proposers in terms of facilities costs was $113 million ($ry) in favor of thiokol after nasa adjustments, and $103 million ($ry) as proposed. the importance of the facility cost evaluated difference is evident since the seb found that thiokol's most probable costs for the total program were $122 million ($ry) less than lockheed's. moreover, the sso pointed to the differences in facilities investment required of the two proposers in making his selection. for purposes of clarity, we deal elsewhere with three of the lockheed facility cost contentions. they are $33.6 million ($ry), $6.9 million ($ry), and $3.2 million ($ry) covering normalization of ammonium perchlorate facilities, nozzle facility requirements, and cost of a rail spur from corinne, utah, to the thiokol plant, respectively.

lockheed and thiokol proposed totally different facility plans for developing and manufacturing srm's. lockheed proposed to modify certain existing, available, government-owned buildings at the michoud assembly facility (maf) in louisiana and at the mississippi test facility (mtf) in mississippi, and to construct new facilities at mtf tailored for certain phases of srm production. thiokol proposed to use, and to modify as necessary, existing facilities at its wasatch division plant site near brigham city, utah.

lockheed planned to use maf for manufacturing processes and operations involving inert srm components, such as final machining of the motor case, grit blasting, insulation, and refurbishment. the company planned to use the mtf site and the new tailored facilities for live motor processing operations, such as grinding, blending and mixing the propellant; casting and curing; and testing operations. the rfp, at section 4.4, already quoted, encourages proposers to utilize that combination of facilities, whether owned by the government or otherwise, which would be most efficient from a cost standpoint. parenthetically, we agree that it is appropriate to select facilities solely on the basis of cost effectiveness rather than provide an evaluation preference for either government-owned or privately owned facilities.

lockheed proposed that the government fund under a separate facilities contract, $37 million ($ry) of non-severable facility items at maf/mtf, such as buildings housing the propellant mixers, and that lockheed and its subcontractors capitalize the remaining $84 million ($ry) of facility items consisting of severable facilities at maf/mtf, such as mixers, as well as the facility items at subcontractor plants.

thiokol proposed to develop and produce the srm through all increments at its existing wasatch division plant after considering various alternative sites. it planned to use its corporate-owned research and development plant, on which several government-owned buildings are located, and air force plant 78, an adjacent government owned, contractor-operated production plant. thiokol chose its existing utah site to achieve cost savings during the ddt&e increment and the production increments.

thiokol capitalized all improvements, modifications, and additions to its existing facilities at $25.30 million ($ry) except certain improvements estimated at $1.1 million ($ry) which thiokol planned to charge direct to the srm program. the only major facility expansion identified in thiokol's proposal is new production capacity for manufacturing ammonium perchlorate (ap). according to the proposal, the ap subcontractors (pepcon and kerr-mcgee) will capitalize these expenditures.

the facilities cost evaluators used their professional judgment in determining whether proposed facility costs were credible, but in lockheed's case, they were able to compare lockheed's mtf and maf facility plans with a preproposal in-house nasa study on srm facility needs at mtf and maf. the costs proposed by lockheed's original proposal closely approximated the nasa in-house study.

in our review, we noted that the seb did not include rental equivalents for the use of government property in assessing the most probable costs of any proposer.

mtf test stand

lockheed contends that the seb unfairly adjusted its proposal cost by $2 million ($ry) for the construction of a new test facility at mtf. lockheed proposed test firings of the srm during increment 1 using one half of an existing test stand containing two bays at mtf which was constructed and used for the saturn program. because the saturn program never developed to its planned level, one side of the stand was never used. lockheed proposed to use this side. according to a preproposal nasa-mtf memorandum from the director-mtf to the space shuttle project manager, pertaining to information on mtf facilities and support services available for the srm project, this test position was reserved for srm testing.

lockheed's proposal said that:

although the b-2 side of the s-ic test stand will be used for space shuttle main engine testing no schedule conflicts are foreseen. we have discussed operation of two sides of the stand with rockwell and nasa engineering representatives and have planned srm operations to prevent schedule impact on either program.

the seb adjusted lockheed's facility costs upward to represent the difference between the cost of a new test stand and the modification costs included in the proposal for special test equipment on the existing stand. the seb justified the adjustment because the srm testing and the main engine cluster testing would be conducted at about the same time and contrary to what lockheed claims would most likely cause schedule conflicts.

the seb disallowed lockheed's use of the stand primarily because of the potential problem of schedule delays and cost impacts caused by concurrent construction and testing. for example, while one contractor is involved in hazardous operations, such as mounting the srm in the stand, other workers would have to cease work resulting in delays. so, the seb decided that it would be more practical and cost-effective to construct a relatively inexpensive horizontal test stand and thus alleviate the potential interference problems.

in addition, lockheed said in its proposal that the test stand required no modifications. as independent nasa-funded study indicated that the existing stand would require additional modification costs because of the way lockheed proposed to test fire the srm. seb evaluators used the study in determining a government estimate of modifications needed.

the gao review reveals no reason to question the seb's justification in requiring a new test stand because of potential schedule conflicts. the additional modification costs are not sufficient to equal the costs of a new horizontal test stand, but these additional costs do somewhat reduce the net effect of the horizontal stand adjustment which was minor overall.

construction of facilities (c of f) cost reduction in best and final offer

lockheed proposed that the government fund, under a separate facilities contract, the non-severable facility items at maf/mtf totaling $42 million ($ry) in its original contract proposal, and $37 million ($ry) in its best and final offer. the nasa report showed proposed c of f costs of $42 million ($ry), not $37 million ($ry). in its cost evaluation, the seb did not accept lockheed's $5.7 million ($ry) best and final reduction. found no contemporaneous documentation to support the nonacceptance. the justification according to seb personnel was that the reduction was unsubstantiated and unacceptable.

we found that although the seb rejected the non-severable c of f reduction, it accepted a $2.61 million ($ry) reduction in the severable mtf facility items. lockheed substantiated its severable facility reduction in the best and final offer exactly like the non-severable reduction, but while one was accepted, the other was rejected.

the seb's acceptance of the $2.61 million ($ry) best and final offer reduction and rejection of the $5.7 million ($ry) was inconsistent since the degree of support was the same. however, we note that the support for the c of f cost in the initial proposal was far more extensive than that in support of the best and final offer. also, the nasa in-house study closely approximated the originally proposed lockheed costs for mtf/maf construction. therefore, the seb could reasonably not have accepted the $5.7 million ($ry) c of f best and final offer reduction or even the $2.61 million ($ry) severable reduction.

comparison of subcontractor facility cost

lockheed claims that the seb incorrectly compared subcontractor equipment costs among proposers to its facilities cost detriment of approximately $3 million ($ry). according to lockheed, the seb included items of its subcontractor equipment costs in the facility cost analysis, and did not include similar subcontractor equipment costs in thiokol's facility cost analysis. even if this were so, the effect upon the overall cost evaluation is academic because the total project most probable cost included all categories of the equipment to be used by thiokol's and lockheed's subcontractors - and both firms proposed substantial subcontracting.

the seb cost team chairman considered the evaluation a valid comparison of facilities which did not include equipment for lockheed and exclude the same type of equipment for thiokol. to examine each piece of equipment and verify equal categorization would require an extensive audit unwarranted in view of the rather insignificant dollar reduction from the facilities cost difference. based upon our examination of documentation in this area, we believe that the seb facility evaluation did not prejudice lockheed.

acquisition of air force plant 78

lockheed contends that because thiokol plans to purchase af plant 78, the seb should include the acquisition costs of the plant in the thiokol overhead costs. lockheed estimated the acquisition cost of the plant as $41 million; and since the nasa report stated a 30 percent utilization for the srm program, an additional $12.3 million ($ry) should be assessed against thiokol's most probable cost. the seb did not add any acquisition costs to the thiokol overhead costs because the seb was not certain whether the sale would ever take place.

on august 3, 1973, thiokol offered to purchase all government-owned facilities at the wasatch division, a portion of which included air force plant 78. the offer was much less than stated by lockheed. according to information submitted in its proposal, thiokol planned that the srm program would account for about 21 percent of the total workload of the wasatch division. therefore, assuming thiokol's offer is ultimately accepted, we estimate that thiokol's srm project overhead would be increased by only a small portion of the acquisition cost, and would be a relatively insignificant amount.

according to seb records, the seb contacted the thiokol air force plant representative office (afpro) to determine the effects of this proposed sale on the srm project. the afpro could give no impact because the details of the sale were not firm at that time. rather than speculate, the seb decided to evaluate the plant based upon it remaining government property, and no cost was added to the thiokol cost tabulation.

we agree with the seb's decision not to include allocable costs of plant 78 in thiokol's overhead costs since the seb had insufficient data at that time to predict the disposition of the plant. in any event, based on available data, the costs chargeable to the srm program in the event af plant 78 is purchased would be minimal.

government support

lockheed in its april 9 submission to gao contends that the seb incorrectly included an additional $3 million ($ry) for government furnished equipment and supplies (government support) in the lockheed cost tabulation displayed in the nasa report. according to lockheed, the seb should have included only $31 million ($ry) rather than the $34 million ($ry) used by the seb.

lockheed's original proposal included $20.9 million ($72) for government support. the proposal did not show the equivalent amount in real year dollars. seb evaluators, in determining lockheed's most probable cost, calculated the government support costs in real year dollars by escalating the proposed amount at a rate of 5 percent which lockheed agreed should have been applied.

our analysis disclosed two basic reasons for the difference in the seb and lockheed calculations.

first, the seb did not accept the lockheed best and final offer reduction for office equipment because lockheed did not furnish adequate substantiation justifying the reduction. lockheed proposed originally that the government purchase $781,000 ($72) of office supplies and equipment for mtf and maf operations. the company changed its approach in the best and final offer to propose using existing supplies and equipment as government-furnished. as such, it excluded the items from the originally proposed government support costs. lockheed did not establish that the proposed office equipment existed at mtf, and the seb did not independently attempt to determine its availability. the second reason for the differences in lockheed and seb calculations is that the seb evaluators apparently did not use the exact proposed lockheed schedule to allocate the government support costs by year. this resulted in a $1.8 million ($ry) difference from computations shown in the nasa report. since lockheed did not provide real year dollars in its proposal, the seb was justified in using its own method of computing escalation in determining the real cost of the government support. we agree also with the seb decision not to accept the best and final reduction for office equipment because of the lack of adequate support. however, rather than using original proposal data, the seb should have displayed best and final data and added an adjustment for the office equipment. in any event, the difference here is also minimal.

residual value of facilities

in its april 9 submission, lockheed states that the seb incorrectly included in the project cost comparison $3.030 million ($ry) of mtf severable facilities which were not depreciated against the srm program. according to our analysis, lockheed's statement is erroneous because the costs of the undepreciated facilities were not included in the most probable cost analysis. we were unable to determine how lockheed planned to recover the costs of those undepreciated facilities. however, the effect was to further reduce lockheed's proposed facilities costs.

lockheed feels the seb should have followed the nathan report which states that the residual value of new government-owned (non-severable) facilities should be estimated and deducted as a negative cost from total facilities costs. the residual value and future use of the government- owned facilities used for srm manufacture are unpredictable at the present. we were unable to determine the value of the proposed government -owned facilities at program completion or what value the facilities would have. as a result, we have no basis to say that the seb should have considered residual value of government-owned facilities in its cost evaluation.

launch site support

lockheed contends that the seb should have included launch site facility and operations costs in the most probable cost evaluation. the seb decided that launch operations were not well enough defined to include in most probable costs but credited lockheed with cost savings associated with its launch operational concepts in the mission suitability scoring.

the rfp required proposers to discuss the effort necessary to support launch site operations. the rfp called for a total view of the influence of the proposer's design of launch site facilities, equipment and operations, including sensitivity manpower and cost data. however, it also stated that the support effort would be procured at a later date under a separate contract.

in support of its position, the nasa report points out that it was not possible to develop a meaningful cost for launch site operational needs because the launch operational concepts at the two launch sites were not fully defined. while the seb adjusted the proposed sensitivity costs which reflected the potential cost minimization of lockheed's launch site cost, the seb felt that the uncertainties existing at the time of the evaluation precluded meaningful cost conclusions. in a letter to gao, nasa further elaborated on the uncertainties existing even today in space shuttle program planning and the ultimate effect on launch site operational costs. our review of contemporaneous seb records, the rfp with emphasis on the sensitivity of proposed launch site operational concepts, and the separate contracting aspects, confirms nasa's judgment as to the inadvisability of considering the launch site operational costs in most probable cost.

maintenance costs

lockheed contends that facility maintenance costs are facility associated and should be combined with construction and equipment costs for a valid comparison, thus detracting from the evaluated facility cost difference in favor of thiokol. the facility cost comparison presented to the sso did not include the $9 million ($ry) maintenance expense differential in favor of lockheed found by the seb.

the rfp definition of facilities and the instructions for preparing the facilities cost proposal did not require including maintenance expenses as a facility-related cost. rather than including maintenance in the facilities cost proposal, both proposers treated maintenance as part of overhead expenses and charged the costs to the total program based upon a percentage of direct labor dollars.

although the seb did not add maintenance expenses in the facility cost evaluation, it did perform a facilities cost effectiveness sensitivity analysis which included maintenance costs along with facilities costs. this analysis which was presented to the sso showed the lockheed advantage in maintenance. the analysis also showed that adding a higher maintenance cost for thiokol than for lockheed made no appreciable difference in the facility comparison.

we conclude that although maintenance expenses are facility associated, the seb was not required to include maintenance expenses in the facilities cost comparison because, by definition, maintenance expenses and facility costs are separate. we also conclude that these expenses have only a minor effect on the facility comparison and that, because maintenance costs are included in both proposers' total cost, there is no impact on most probable cost.

other seb adjustments

the seb adjusted lockheed's proposed costs because of omissions in costs associated with modifying mtf property. lockheed did not refute these adjustments in its april 9 submission. based on the seb documents, lockheed omitted costs for the on-plant railroad spur called for in its proposal, a security fence and guard house, and additional sitework needed to prepare the mtf area.

lockheed proposed to build an ap grinding and blending facility at mtf to meet srm demands for increment 1, but also it proposed to abandon this facility and build a larger grinding and blending facility at a vendor location in northeast mississippi to meet demands for increments 2 and 3. this would save manhours and eliminate steps in the manufacturing process. the seb decided that this plan created too great a risk; so, for purposes of evaluation, it relocated the grinding and blending process to mtf and adjusted lockheed's cost upward for additional grinding facilities at mtf. our review found no basis to disagree with this minor adjustment.

as stated previously, in addition to the capitalization of facilities by lockheed and its subcontractors, lockheed proposed that the government furnish the non-severable facilities at mtf through a separate facilities contract. lockheed showed these costs in its proposal and escalated to real year dollars using a 7 percent per year escalation factor. the seb adjusted lockheed's escalation to 8 percent, the same percentage nasa used in its budget request for c of f funds and applied equally to all proposers who proposed c of f funding. this resulted in the largest facilities adjustment.

in summary, we concur with the seb adjustments made to the lockheed proposed facility cost. all adjustments were adequately justified, documented in the seb records, and constituted a minimal increase in its most probable cost.

the seb found no deficiencies worthy of adjustment in the thiokol facilities plan. our review included many thiokol weaknesses identified during the evaluation process as possibly requiring cost adjustments. found that all potential thiokol adjustments were properly eliminated or classified as cost uncertainties by the seb. we believe the seb conducted the facilities evaluation in a reasonable and thorough manner and its results fairly reflect the facilities cost differences between the proposers.

our conclusion that ammonium perchlorate costs should have been normalized has the effect of reducing the facilities cost differential in favor of thiokol ($113 million ($ry)) by about $34 million ($ry). the two proposers' facilities costs were amortized into the cost per pound of ap. by normalizing to a common cost per pound, proposed ap facility costs differences - $44 million ($ry) for lockheed and $10.6 million ($ry) for thiokol - are, therefore, eliminated.

transportation costs

the seb found a most probable cost difference of $36 million ($ry) in favor of lockheed in the transportation cost area. lockheed believes this difference should have been substantially increased.

the rfp required that each proposer submit a detailed proposal setting forth its methods of shipment. the terms of delivery of the finished product, the srm, were free on board (fob) destination, the eventual contractor having total responsibility for shipment costs between production and test or launch sites. the source evaluation plan called for the seb to evaluate the transportation area under the rfp evaluation factors of mission suitability and cost.

thiokol transportation plan

thiokol proposed a distribution plan based on railroad transportation. raw materials and parts would be shipped from subcontractors to its production facility near brigham city, utah. finished srm's and refurbishable cases and nozzles would be shipped between its production facility and the test site at huntsville, alabama, and launch sites at cape canaveral, florida, and vandenberg air force base, california.

all line-haul railroad equipment, principally the rail cars, would be supplied by the various railroad carriers or secured from the department of defense (dod) rail car fleet. until 1979 - the last year in increment 1, all shipments would have to be transferred between rail cars and over- the-road trailers for shipment to or from the closest railheads at corinne, and brigham city, utah. transport between the railheads and the production facility would be provided by motor truck carriers using existing or new equipment.

for shipments beginning in 1979, thiokol would have the union pacific railroad build a rail spur of approximately 20 miles between the closest railhead, corinne, utah, and the production facility. in a letter to the seb, the railroad indicated that it would build the spur dependent on the total industrial development activity within the industrial complex area and the eventual award of the srm contract to thiokol.

thiokol substantiated its transportation cost proposal with commercial freight rate tariffs, special government freight rate quotations (section 22 tenders), and letters of intent from a commercial motor carrier and a railroad freight rate bureau. on the basis of our analysis of thiokol's proposed shipping plan, 64 percent of the overall shipping costs would be based on section 22 rates. about 43 percent of the overall shipping costs would be based on a $2.50 per hundred-weight section 22 rate for shipping the srm's from utah to the principal launch site at cape canaveral.

rates and charges for surface freight transportation within the united states are regulated by the interstate commerce commission (icc) under authority of the interstate commerce act, 49 u.s.c. 1, et seq. these rates and charges must be filed with the icc and published in tariff or schedule form, or, if offered solely for the use of the government, in tender or rate quotation form.

special rates to the government are offered voluntarily by common carriers, such as railroads, under section 22 of the act (49 u.s.c. 22) which provides as follows:

\*\*\* nothing in this chapter shall prevent the carriage, storage, or handling of property free or at reduced rates for the united states \*\*\*.

unlike tariff rates, which are available to the public as well as to the government and which must be filed with the icc generally a minimum of 30 days before they can be made effective, section 22 rates can be made effective immediately and even retroactively. whereas increases or decreases in tariff rates may be suspended by the icc, section 22 rates are not subject to icc suspension and may be increased, decreased, or even canceled at the discretion of the carrier offering the rates, subject to any agreements made between the carrier and shipper using or planning to use the rates.

all of thiokol's transportation charges for the finished srm's and fired hardware between the utah production facility and the two launch sites were based on section 22 rates. all have been filed with the icc and are open to public inspection. the principal section 22 rate objected to by lockheed is to cape canaveral with finished srm's, $2.50 per hundredweight, subject to a minimum charge of 1,000,000 pounds loaded on not more than five rail cars.

the section 22 rate quotation to be utilized by thiokol states:

this quotation may be cancelled by written notice of not less than thirty (30) days by either party to the other, except as to shipments made from original point of shipment (or port of importation where involved) before the effective date of such notice, and except as to any accrued rights and liabilities of either party hereunder, and further such cancellation may be accomplished upon shorter notice by mutual agreement of the parties concerned. modification of the quotation may be accomplished by the railroads parties to this quotation upon shorter notice subject to mutual agreement of the parties hereto. we note here that the section 1.1313-2 of the nasa procurement regulations (nasa pr) specifically provides for and permits the use of section 22 quotations in the performance of cost reimbursement contracts.

lockheed transportation plan

lockheed proposed a distribution plan based on a combination of railroad and barge transportation. raw materials and parts would be shipped by railroad from subcontractors to its srm production facilities at maf and mtf. finished srm's and refurbishable cases and nozzles would be shipped by barge between the production facilities and the test and launch sites.

all line-haul equipment, principally the rail cars and barges, would be supplied by either the railroads, lockheed's subcontractors, or nasa. until 1980 - midway through increment 2 - lockheed would use nasa's existing saturn barges, strengthened to carry the srm weights. the barges would be towed by commercial carriers.

beginning in 1980, lockheed would transport the rocket motors in a motorized barge built by a private contractor. the barge would also be used to ship the external tanks - expendable fuel tanks for the space shuttle orbiter vehicles - from the tank manufacturer at the maf. as the production schedules warranted, the motorized barge would be supplemented by the nasa barges until the need for a second motorized barge was justified. the second barge would be necessary about 1983, a third of the way through increment 3.

lockheed contentions

lockheed contends that nasa's acceptance of thiokol's section 22 rate of $2.50 per hundredweight to the principal launch site in florida was unreasonable. in support thereof, lockheed states that the rate is less than one-third of the going rate for a similar commodity, the titan-iii solid rocket motor currently being produced by utc for the air force. furthermore, lockheed claims the rate is destructive of competition and, as such, unlawful under the interstate commerce act. it is pointed out that section 22 rates are not reliable bases to establish probable costs to the government over this 15-year program because the railroads can withdraw them at any time with only 30 days notice. if the rate were withdrawn, any possibility of achieving an equivalent alternative published tariff, such as a point-to-point commodity rate, is questionable. also, lockheed questions the escalation rate proposed by thiokol as finally adjusted by the seb in view of recent rail rate escalation history.

lockheed further claims that thiokol's transportation costs should have been increased to account for (1) the construction of the rail spur between corinne and the production facility, (2) additional cases and nozzles because thiokol's round trip transit times are insufficient to meet the launch rate requirements, and (3) an extensive test program to verify the safety aspects. finally, lockheed questions nasa's failure to fairly credit the benefits of its plan insofar as it calls for shared transportation with the external tank to be transported to the launch sites by a separate government contractor or the government.

section 22 rates

a substantial amount of government traffic moves on section 22 rates. a recent study of shipping practices of dod, we found that 81 percent of dod's railroad carload traffic, in terms of dollars spent, moved on section 22 rates. almost 100 percent (99.4) of the ammunition and explosive traffic, which would include solid rocket motors, moved on section 22 rates.

we analyzed the section 22 rates used by thiokol in its proposal, and we conclude that nasa's acceptance of those rates was reasonable, even though they were significantly lower than existing or similar rates for the same commodity. for instance, the existing solid rocket motors rate as of august 1, 1973, from corinne, utah, to the railhead nearest cape canaveral was $7.62 per hundredweight, subject to a minimum chargeable weight of 36,000 pounds. this was a commercial class tariff rate, available to any and all shippers. we are not aware of any traffic actually having moved at this rate.

the largest-sized rocket motors presently shipped are the 120-inch diameter, titan-iii motors (as compared to the approximate 146-inch diameter of the srm's) from california to cape canaveral. on august 1, 1973, about 3 weeks before proposals were submitted, the titan motors were moving on section 22 rates of $8.24 per hundredweight with a minimum chargeable weight of 40,000 pounds. if the section 22 rate had not been available, the motors would have moved at a class tariff rate of $9.20 per hundredweight minimum chargeable weight of 36,000 pounds.

comparatively, the thiokol section 22 rate of $2.50 per hundredweight is a reduction of about 67 percent of the existing class rate ($7.62) while the titan section 22 rate ($8.24) is only a 10-percent reduction of its class rate ($9.20). however, the minimum chargeable weight of 1,000,000 pounds for the thiokol rate is almost 28 times greater than the minimum chargeable weight of 36,000 pounds for its class rate. the minimum of 40,000 pounds for the titan rate is only a tenth greater than the minimum of 36,000 pounds for its class rate. thus, any evaluation of a rate per hundredweight must be examined with reference to the applicable minimum chargeable weight.

our calculations show that, when a set of srm's is shipped from utah to florida, the railroads will receive revenues of almost $60,000 or 1.9[ per ton-mile. the titan solid rocket motors will provide revenues of about 94,000 or 5.1[ per ton-mile. however, over the last 10 years only 50 titan motors have been shipped, yielding about $348,000 in revenue per year. during the primary shipping years, 80 srm's will be shipped annually, producing revenues for the railroads of over $3 million a year. thus, it can be concluded that although the rate per hundredweight for the srm's is comparatively low, the expected revenues over the life of the procurement are comparatively high.

in the course of its evaluation, the seb asked the two prime government traffic managing agencies whether the section 22 rate was reasonable in view of the significant reduction from the corresponding class rate. the substance of the replies was that it is not unusual for a section 22 rate to be 67 percent below its corresponding class rate. similarly, we believe that section 22 rates are essentially the same rates that a commercial shipper would receive in like situations under commodity rates filed with the icc.

other factors were considered in our determination. for example, section 20(11) of the interstate commerce act generally makes the railroads liable for the full value of the commodities shipped. the section 22 rate to cape canaveral applies only when the released value of the srm's does not exceed 50[ per pound. the class rate applies only when the carriers assume full liability. according to our estimates, the value of the srm's is well above 50[ per pound. a reduction in the carrier's liability is a valid and necessary reason for a reduction in freight rate.

perhaps most significant is the fact that according to our calculations all the various section 22 rates proposed by thiokol yield a profit to the carriers offering them. based on icc cost data, the section 22 rate to cape canaveral is 125 percent above cost. without making any statement whether these profits are comparatively high or low, we conclude that any statement to the effect that these rates are unprofitable is without merit.

the section 22 rates used by thiokol can be canceled upon 30 days notice. a 30-day cancellation provision is fairly standard with such rates but it is unusual for any railroad to cancel rates if the traffic for which they were offered still exists. officials at union pacific, the railroad which offered the rates to thiokol, represented to thiokol that they could not find any section 22 cancellations for traffic that still existed. they also stated they would support the same level of rates in a commercial tariff if section 22 was repealed by congress. however, it is noted that such new commercial tariff would be subject to the provisions of the interstate commerce act.

many attempts to repeal section 22 of the act have been made in the congress since 1950. at present, three bills are pending. there is no indication what action congress may take.

over the years, the position of the principal government shippers has been that rates offered under section 22 are merely those rates which any shipper would negotiate in similar circumstances, given the volume and frequency of the government's shipments. were section 22 not available, we believe, the government would probably be able to negotiate similar tariff rates, but the ability to obtain those rates as quickly or retroactively, as is possible under section 22, would be lost since any new commercial tariff rate would be subject to the provisions of the interstate commerce act.

within the framework of the interstate commerce act, the icc can suspend tariff rates which are unjust or unreasonable, unjustly discriminatory, or which give undue or unreasonable preference or advantage. the term "destructive" is found in the national transportation policy, which precedes each of the four parts of the interstate commerce act. in that policy it is stated:

it is hereby declared to be the national transportation policy of the congress to provide for fair and impartial regulation of all modes of transportation \*\*\* so administered as to \*\*\* encourage the establishment and maintenance of reasonable charges for transportation services without unjust discriminations, undue preferences or advantages, or unfair or destructive competive practices \*\*\*.

questions of a rate being "destructive" can be raised before the icc. however, since the landmark decision about section 22 rates before the icc (tennessee products and chemical corp. v. louisville & nashville r.r. co., 319 i.c.c. 497 (1963)), the icc has taken the position that it lacks power to suspend section 22 rates as being unjust or unreasonable, unjustly discriminatory, or giving undue or unreasonable preference or advantage. thus, it is apparently the icc's position that it lacks power to find section 22 rates "destructive."

a party may contend that section 22 rates are too low in relation to existing rates or to rates which non-government shippers must pay. and a party may contend that such rates require other shippers to subsidize the government's traffic or subject competing carriers to operate at an extreme disadvantage. however, congress, with the enactment of section 22, authorized the carriage of government property free or at reduced rates. only congress has the power to modify or repeal section 22.

transportation cost escalation

having discussed the reasonableness of the basic rate, we turn to the projection of the level of future freight costs to be incurred over a 14- year period, from 1975 through 1988, which was a major problem for the seb. the rfp did not specify levels of escalation to be used nor did the board attempt to normalize the various levels proposed.

in its proposal, thiokol stated it had escalated its transportation costs at a rate of 2 1/2 percent per year for the finished srm's and 2 percent for all other parts and raw materials. the seb adjusted thiokol's proposed rate of escalation for the srm's from 2 1/2 percent to 5 percent, but only for increments 1 and 2. in so doing, the seb admits that it inadvertently failed to adjust thiokol's increment 3 costs.

the seb's rationale for its adjustment of the thiokol escalation rate was that in evaluating transportation costs, it was determined that the 2 1/2 percent per year escalation proposed by thiokol was insufficient. the seb assumed that the economy in the long range during increment 3 would stabilize and that 2 1/2 percent per year in that time frame would be adequate.

it was felt that the negative effect of a transportation cost growth greater than the seb projected escalation of 5 percent would be primarily an increment 3 consideration and could be factored into the competition for that increment. the seb further relied on the following: (1) the general services administration (gsa) uses a projection of 5 percent per year and, for its studies, anywhere from 4.5 to 5.2 percent; (2) the president of the union pacific railroad, which offered the section 22 rates, believes thiokol's use of 2 1/2 percent would appear to "reasonably cover" increases through 1988 based on history; and (3) the defense contract audit agency took no significant exceptions to the proposed costs.

no informed source has been willing to provide us with a figure to use in projecting transportation freight rate increases over the life of this procurement. certain government officials involved in procurement stated they had no experience with contracts of a 15-year duration. most of their contracts were for only 1 year.

as far as historical increases in rail rates are concerned, since 1944 (through december 31, 1973), there have been 28 general, or across the- board, increases in railroad freight rates which essentially have applied to section 22 rates. over the past 7 years, from january 1, 1967, to december 31, 1973, freight rates have increased an average of 5.6 percent per year. over the past 15 years, freight rates have experienced an average increase of 2.7 percent per year. since december 31, 1973, cumulative increases of 17.9 percent have been approved by the icc, including a 10-percent increase granted on june 5, 1974 (it should be noted that these increases occurred after the seb evaluation and the selection). in the last 25 years, no year has had increases exceeding 17.9 percent. however, 17.0 of the 17.9 percent is scheduled to expire in early 1975, although there is no assurance that the increase may not be extended or even increased.

a further concern with thiokol's escalation was the fact that thiokol stated during the discussions that it would be cost-effective to manufacture the srm's for launch from cape canaveral at an east coast site, such as its plant at brunswick, georgia, if the rate from utah to cape canaveral was increased from $2.50 to $5.94 per hundredweight. according to thiokol, an increase of that magnitude was unreasonable, but if it appeared that the rate would be reached, it could start construction to increase the size of its brunswick plant as late as july 1, 1980. using a percent rate of escalation recommended by lockheed for thiokol of 6 percent, the $5.94 rate would not be reached until 1988, or the end of the srm program.

based on history, thiokol appears to have understated its projected freight rate increases. the seb increased the escalation rate to 5 percent in the first two increments, but failed to consider the effect that increase would have in increment 3 and, thus, also failed to adjust increment 3 costs upward by about $6 million ($ry), which nasa acknowledges.

while thiokol may be able to hold its freight rate increases to below the average of future general increases, given the possibilities of negotiating lower rates, we believe there is at least $6 million ($ry) of additional cost uncertainty related to its freight rates for the srm using the seb's 5 percent rate of escalation throughout the program. this would also mean another $6 million ($ry) of additional cost uncertainty for shipments of the raw materials and parts for all three increments.

since the cost evaluation was performed on the basis of most probable costs for the entire program, the impact of increment 3 competition should not have been a consideration.

accordingly, the seb's adjustment to thiokol's proposed transportation costs should reflect the $6 million ($ry) admitted error and additional cost uncertainty should reasonably have been about $12 million ($ry). although the seb could have shown the $12 million as an adjustment, we note that lockheed claims that any escalation rise should impact upon cost uncertainty, rather than cost adjustment, which nasa should have considered.

we observe that the seb accepted lockheed's escalation rate applicable to its water shipment of the finished srm's and refurbishable hardware. approximately 58 percent of proposed costs relate to barge costs and 42 percent to railroad charges. while the lockheed proposal is silent as to its srm escalation rate, we believe that 3 percent approximates what was used.

with respect to lockheed's base level barge rates, lockheed based its costs on a subcontractor's bid - but adjusted that bid approximately 60 percent downward to compensate for change in construction site, longer amortization period, and smaller operating crew. in response to an seb question, lockheed submitted a letter from its proposed subcontractor which stated in part, as follows:

realize your best estimates are significantly less than our proposal dated august 9, 1973, nevertheless, am willing to negotiate on the basis of 1972 dollars.

lockheed did not state in its proposal what contractual arrangement it would have with that subcontractor if it won the srm contract. unlike thiokol, which was proposing to use the icc-regulated railroads at rates required to be open to public inspection, lockheed was proposing a system based on an entirely new mode of transportation for which we have no historical rate patterns.

while the proposed transportation would be interstate commerce, the nature of the commodities to be shipped and its freedom from meaningful competing modes of transport could possibly mean that it would be exempt from icc regulation. see 49 u.s.c. 903. because of these facts, there was no way to verify lockheed's proposed barge costs. the seb recognized this and made no adjustment.

regulated water transportation charges have traditionally been set at levels related to rail rates. increases have also been related to rail increases and have often been the same. water carriers have encountered increases in operating costs comparable to those experienced by the rail carriers. however, for the type of transportation lockheed is proposing, increases will be directly related to increases in barge construction costs and crew and bunker fuel charges, which may or may not bear any real relation to rail cost increases or regulated water carrier increases. because of the lack of verifiable cost information, we have no cost data to refute lockheed's base or escalated costs. yet, we believe the seb should have found substantial cost uncertainty in this area. we believe that, whatever the difference between what the potential supplier apparently proposed and what lockheed adjusted that to, should reasonably have been shown as an uncertainty on the record at that time. that reasonably would have been several million dollars.

additional transportation considerations

the seb made no cost adjustments or assessments of cost uncertainty in relation to thiokol's need for (1) special, heavy-duty rail cars, (2) shock-resistant shipping containers, or (3) a rail spur between the railhead at corinne, utah, and the thiokol production facility. believe the board was correct in not making cost adjustments, but should have found some additional cost uncertainty.

thiokol stated in its proposal that the railroads would provide the necessary heavy-duty rail cars without additional cost. the seb verified this information with thiokol which provided backup information from the railroads involved. we believe the seb was correct in relying on the verification.

however, the seb cited thiokol for a weakness in failing to propose shipping containers which would meet nasa's rfp requirement to use containers sufficient to resist railroad bumps and shocks. thiokol responded that the rfp requirements were excessively high and said it would run a test with its srm containers to substantiate that. the seb made no cost adjustment even though if the test proved negative, the possible additional cost would be $950,000 ($72). the board indicated that this was an item for negotiation after award of the contract. believe the board would have been justified in listing the $950,000 ($72) as a cost uncertainty.

thiokol also proposed that the railroad (union pacific) would build a rail spur the 20 miles from the nearest railhead corinne, utah, to the plant site. it stated that it had held discussions with the railroad about the spur and the cost of construction was estimated at $3 million ($ry). when the seb queried thiokol about the rail spur, thiokol had the railroad respond directly to the board. the president of union pacific railroad replied:

in january 1972, a group of our people visited thiokol and discussed the possibilities of union pacific constructing track to the plant site to accommodate the space shuttle program. we estimated the cost of building the railroad at three million dollars. any decision on the part of the railroad to construct the industrial track at its expense would necessarily depend on the total industrial development activity within the area and the award of the srm space shuttle program to thiokol. however, we must see some progress in the development phase before we make any investment for industrial trackage.

let me assure you that union pacific is extremely interested in participating in the space shuttle program. the section 22 rates we developed for the program provide us with an adequate profit, and while the railroad stands ready to build the necessary industrial track, decision as to who will fund this project depends on the future development of the industrial complex.

while there is no assurance that the railroad will build the spur, thiokol has offered as much substantiation as was possible at the time of the proposal. accordingly, we find no basis for cost adjustment, although a cost uncertainty of $3 million ($ry) may have been appropriate, since there is a possibility that thiokol would have to fund the spur.

the seb found both of the proposed transportation plans suitable for the planned procurement. safety factors were considered and it was agreed that the barge system presented fewer problems than the rail system. admittedly, rail transportation would subject the srm's to the harshest transportation shock and vibration. because the railroads would traverse populated areas, the public along the rail routes would be subjected intermittently to a substantial volume of potentially hazardous explosives. although the srm is classified as an explosive, its greatest danger is fire, not explosion. unlike the recent rail disasters referred to by lockheed which related to the explosion of bombs in california and arizona, the srm's in a rail disaster would create a large, fast-burning fire. on the other hand, if a disaster befalls lockheed's motorized barge, it would have a substantial impact on lockheed's overall distribution system.

we believe both plans are satisfactory from the standpoint of safety and no adjustments or assessments of uncertainty were necessary.

thiokol's proposed round trip transit times between the production facility and launch sites were as follows:

to cape canaveral - 22 days (7 days each way and 8 days for on/off loading)

to vandenberg - 7 days (1.5 days each way and 4 days for on/off loading)

the seb's refurbishment and product support panel considered the transit time of 7 days between utah and cape canaveral very optimistic. it felt that 12 days each way was more realistic. thus the round trip time is 32 days. plotting the transportation time required against the number of additional cases which would be required, the panel estimated a requirement for two additional sets of case containers (eight containers total). the seb authorized an adjustment and increased thiokol's proposed charges to cover this.

three of the four rail carriers who were party to the original section 22 route (union pacific to kansas city, missouri; missouri pacific to memphis, southern to jacksonville; florida east coast to titusville, florida) told the seb that a transit time of 7 to 9 days was realistic. missouri pacific, the fourth carrier, indicated that 46 hours over its routes was expected. since the missouri pacific route is only 539 of the total 2,606 miles between corinne and titusville, without adding the highway mileage to and from railheads (approximately 22 and 14 miles, respectively), the 7 to 9 transit day times appear to be slightly optimistic. however, union pacific said the 7 to 9 transit day times were based on an october 1972 test simulating the anticipated srm weights and dimensions. since missouri pacific's 46 hours were included in that time, we believe 7 to 9 days between the railheads was a reasonable, though somewhat optimistic, estimate.

at the present time, there are 14 other possible routes in the utah to florida section 22 quotation. we do not know what transit times are possible on those routes. because the seb increased the round trip transit time for thiokol, the seb adjusted thiokol's case requirements by eight. upon review, we find the transit times estimated by thiokol were reasonably accepted by the seb. the seb did not add the costs for transportation of the additional eight cases due to a previous overadjustment in the number of cases required.

another part of the space shuttle hardware is the external tank. the contract for the tanks has been awarded by nasa to martin-marietta who will manufacture them at maf. nasa will provide the transportation of the completed tanks to the launch sites.

although nasa's preproposal transportation study had recommended the initiation of a transportation cost study for integrating external tank and srm transportation requirements if the selected srm production location was accessible by water, the rfp contained no statements about the possible savings of co-shipment. there was no indication that nasa would compute savings in external tank transportation with the srm procurement in its evaluation.

in its proposal, thiokol stated it had examined transportation by barge from the gulf coast and mississippi river and found that it was entirely feasible to deliver loaded srm's to maf or mtf for carriage by barge to canaveral. it felt that co-shipment with the tanks might be cost- effective, but presented no cost savings data. lockheed based its cost proposals on the co-shipment feature. lockheed's barge costs were proposed at 50 percent of its actual costs, with the other 50 percent shown as a savings to the government for not having to provide all the external tank transportation. the seb accepted the data and credited lockheed with its proposed savings to the government of about $10 million. in addition, the seb performed a sensitivity analysis wherein it was presumed that all srm costs associated with external tank co shipment or $10 million were eliminated.

if the external tanks are not shipped with the srm's, there will be a substantial additional cost. however, the seb cited no basis in its reports to judge what those additional costs would be. to have given lockheed credit for savings related to the tank transportation when the rfp did not ask thiokol or any of the proposers to offer a plan to minimize the total transportation costs of the two procurements was questionable. lockheed claims that the additional $10 million credited in the sensitivity analysis should have been included as a further reduction in its most probable costs. furthermore, lockheed believes that an additional $6 million savings would accrue to the external tank program based on the government's estimated costs. nasa's treatment of the lockheed plan for shared transportation of the srm's and external tanks was inconsistent. the seb's own evaluation gave partial credit for such savings but, for no apparent reason, considered potential additional savings in a different manner. in our view, lockheed should have received credit in its most probable cost for either all definable savings or none at all. since the decision as to how the external tanks will be shipped has not been made and therefore, its cost is uncertain at present, it is difficult to quantify what penalty lockheed suffered from nasa's failure to credit full savings to its shared transportation plan. our estimate closely parallels the lockheed estimate of $16 million. but even attempting to estimate what actual savings might occur is extremely speculative. this is so because nasa's estimate of external tank transportation cost was made in march 1973 before either the external tank or srm rfp's were issued. it is conceivable that the nasa estimate relied upon by lockheed for full savings credit might be revised substantially prior to the actual shipment of any external tanks if lockheed is awarded the contract. also, in fairness, the ground rules for competition did not provide for factoring savings on the external tank into the srm most probable costs.

in view of the above, we believe that lockheed should have received appropriate credit for external tank savings as a positive cost uncertainty keeping in mind that nasa's actions might very well be viewed as an unwarranted positive adjustment to lockheed's proposal and an undue reliance upon a proposed cost savings.

conclusion

we believe the seb correctly took a conservative approach in making several relatively small cost adjustments. we found only one major error in mathematics, a failure to adjust thiokol's escalated costs properly. the seb did assess greater cost uncertainty against the thiokol proposal than the lockheed proposal, but the amounts were insignificant. were the seb to reevaluate the transportation area, we doubt that any major differences would be uncovered from what it had originally done, except perhaps in a new approach to evaluating shared external tank/srm transportation costs.

railroad charges are subject to the interstate commerce act while barge charges are probably free to float subject to agreements between the parties involved. because of the difference, there appears to be no overriding reason to have normalized escalation here.

we believe nasa could have more adequately evaluated the srm transportation costs if it had either examined these costs together with the costs for shipping the external tanks, or totally rejected any reference to the shared tank transportation costs. as it turned out, the seb essentially accepted each proposal. lockheed was given the benefit of a savings for sharing costs with the tank shipments even though there was no firm rfp statement providing for evaluation of these savings.

we believe the freight rates proposed by thiokol were reasonable and properly accepted by the seb, notwithstanding that they were section 22 rates subject to a 30-day notice cancellation provision. our bases of finding are that: (1) the rates were actually negotiated and agreed to between thiokol and the railroads; (2) the type of traffic proposed has generally moved on section 22 rates; (3) the volume and frequency of the proposed traffic justifies lower than existing or comparative rates; (4) the railroads have been considered reliable in the past in offering and maintaining reasonable rate levels; and (5) using available cost information, all the proposed section 22 rates are compensatory.

we believe the costs proposed by lockheed, particularly the barge transportation costs, were somewhat less certain than thiokol's. this is because: (1) there was no agreement in the proposal between lockheed and the potential subcontractor as to the anticipated costs; (2) the proposal did not state what contractual arrangement lockheed would have with the potential subcontractor; (3) the potential subcontractor has no record, to our knowledge, of offering or maintaining any freight rates to the government; and (4) there is no historical cost data to evaluate the proposed costs since no barge of the type proposed exists in the u.s. fleet today. despite an after-the fact concurrence with lockheed's reduction of the subcontractor quote, there is no guarantee that lockheed's potential subcontractor will agree to the changes lockheed proposed much less maintain them when shipments are actually made.

in the matter of escalation of transportation costs, using history as a guide, we find thiokol's escalation basis not unreasonable for purposes of the most probable cost evaluation. however, recent increases in freight rates, since the proposal was submitted, have been far above the average past increases. yet, there is no assurance that over the 15 years of the procurement, the average as proposed will not be met. nor is there any assurance that history will prove reliable. lockheed's proposed escalation of transportation costs was not clearly stated. because the actual basis of charges has never been firmly established, no escalation factor could be applied with certainty.

lockheed's evaluated $36 million ($ry) transportation advantage in most probable costs resulting from utilization of water transportation at the proposed location of its production facility in the southeast closely approximates our conclusions. we did find further areas where we might have assessed additional cost uncertainties against thiokol and favorable and unfavorable cost uncertainty to lockheed. however, we do not believe that the net uncertainty from our evaluation would serve to call for a conclusion on our part of unreasonableness in the transportation evaluation by the seb.

labor rates

lockheed challenges the seb's labor rate evaluation maintaining that a penalty was assessed against it of $21.1 million ($ry) in direct labor costs and an additional $20.4 ($ry) when overhead and general and administrative (g&a) rates are applied for a total of $41.5 million ($ry). lockheed states the major issues are that the seb (1) questioned lockheed labor rate survey data in the gulf coast area (mississippi and louisiana), (2) incorrectly determined its starting composite labor rate, (3) used an arbitrary method for adjusting post 1975 labor rates, and (4) failed to decrease lockheed's overhead and g&a rate to account for the upward adjustments in its direct labor costs.

the gao review found that the total adjustment for lockheed was well below $41.5 million ($ry). lockheed's total claimed penalty analysis was based on several incorrect assumptions derived from the nasa report.

a short explanation of how labor rates were developed and proposed is necessary to fully understand the issues raised by lockheed. composite labor rates were shown in lockheed's and thiokol's proposals for increments 1 and 2 as required by the rfp. lockheed proposed seven composite direct labor rate categories (e.g., engineering and operations), each of which included direct hourly and direct salary rates. the individual rates were weighted to reflect the number of hourly and salaried personnel and their various individual rates included in each composite rate. thiokol proposed four categories of composite direct labor rates.

lockheed developed its proposed composite labor rates by (1) conducting a survey of hourly rates in the mississippi-louisiana area where its production sites were to be located, (2) assembling the survey data into labor categories it planned to use, and (3) adding to the hourly rate, through weighting described above, the rates for salaried personnel it planned to transfer from california to the gulf coast area in 1975 for the duration of the program and the rates for salaried personnel it planned to hire in the gulf coast area. lockheed included factors in its calculations to reflect the changes in the labor force and escalation of rates for each succeeding year of the program.

thiokol developed its composite labor rates from its historical data and projected it over the succeeding years of the program using escalation factors.

it is important to point out that lockheed planned on a facility dedicated to the srm program whereas thiokol planned to use a facility housing other solid rocket motor programs. under these conditions, lockheed's labor costs are considered direct and are included in the composite labor rates. in thiokol's case, a significant percentage of labor cost is considered indirect - chargeable to several contracts - and is not included in the composite labor rates. these differing circumstances tend to increase lockheed's composite labor rate and reduce thiokol's composite labor rate. however, the differences tend to be balanced in the total program costs since lockheed's indirect labor cost is excluded from its overhead cost while thiokol's overhead costs include indirect labor cost.

low mississippi-louisiana hourly labor rates

we examined statistical data from the bureau of labor statistics (bls) and the basis for lockheed's and thiokol's proposed rates. the bls statistics for louisiana and mississippi (lockheed's proposed sites for the srm) and utah (thiokol's proposed site) show the following average, state-wide hourly rate for employees working on transportation equipment which includes guided missile and space vehicle propulsion units and propulsion unit parts:

1972 1973

mississippi $3.86 $4.03

louisiana 3.80 4.16

utah 4.39 4.46

using the above combined mississippi-louisiana figures for 1972-73 the average rate would be $3.96 per hour. for utah, it would be $4.43, or 47 cents higher than mississippi-louisiana.

the gao review also included an examination of lockheed's survey data for hourly employees for the mississippi-louisiana area and thiokol's actual hourly rates for about the same period of time which substantiates, within an acceptable range, the published bls data.

regarding the mtf area labor rate survey conducted by lockheed, dcaa stated, "the exact use of the data obtained by the contractor could not be determined as no documentation was maintained demonstrating the weight given to the various inputs." according to dcaa, the contractor stated that the information was used subjectively to arrive at the proposed rates for the gulf coast area. as discussed below, gao believes that, even with the survey information provided by lockheed in its april 9 submission, the seb could not have determined the extent to which lockheed used this data in developing its proposed composite rates.

lockheed's proposed composite labor rates for 1975

according to nasa and dcaa, lockheed's method of computing proposed composite labor rates contained a mathematical error which distorted the starting composite labor rate lockheed applied after relocation at the mtf in 1975 and the remaining composite labor rates over the life of the program. dcaa detected the error during its review of lockheed's proposal. dcaa discussed the error with lockheed's cost analysts and computer programmer to obtain clarification of the method lockheed used in developing the proposed composite labor rates. the company representatives, according to dcaa, stated that lockheed's method was not incorrect. dcaa, after correcting the mathematical error in lockheed's formula did not recommend its use because of defects in the formula's underlying assumptions. therefore, the seb did not use the formula. instead the seb used dcaa-recommended 1974 composite rates based on the california facility reduced by 10 percent to reflect lower labor rates in the gulf coast area. in this way, the 1975 composite direct labor rates were established for lockheed.

gao conducted an analysis in conjunction with lockheed as to the basis for its proposed direct labor costs. several errors were detected in lockheed's calculations with respect to its composite labor rates which indicated that its labor costs should have been higher. after discussion, lockheed, in a document submitted to gao, recalculated the direct labor costs that appeared in its proposal. the recalculation resulted in a correction of those costs upward by an amount considerably greater than the seb's adjustment to lockheed's proposal. if the seb had evaluated lockheed's labor costs consistent with the lockheed recalculation, the seb may well have increased lockheed's most probable cost by about $15 million ($ry). in providing gao with its direct labor cost, lockheed essentially corrected the dcaa discovered defects in its labor rates formula.

during our review, the seb personnel involved in the evaluation of lockheed's labor cost said, and we verified, that the error detected by dcaa during its review caused lockheed's quoted composite labor rates to be low (understated). in its evaluation, the seb found that lockheed had higher composite direct labor rates than thiokol. we note that the labor rates for the salaried personnel lockheed would transfer from california to mtf were based on 1973 rates for similar job categories at lockheed's california facility. also, lockheed's proposed composite rates apparently include salaried personnel receiving higher salaries than proposed by thiokol. in addition, as noted above, a significant percentage of thiokol's labor costs are not included in its composite labor rates. while mississippi-louisiana hourly labor rates are lower than comparable rates in utah, and lockheed properly estimated these rates, the combination of the above factors support the seb's conclusion that lockheed's composite direct labor rates are higher than thiokol's. lockheed's post-1975 composite labor rates

lockheed alleges the seb's method of adjusting post-1975 composite labor rates is arbitrary, stating:

the correct procedure is to build the composite rate from its elements treating escalation, staffing changes, and starting rates for new hires independently. lockheed used this approach, but made an error in application in the proposal costs. the lockheed best and final offer was correct, however, and did not contain the application error.

dcaa reviewed lockheed's proposed composite rates and determined them to be incorrect because of an error in the formula lockheed used to establish the 1975 and post-1975 rates. if the seb had used the lockheed formula as corrected by dcaa, the resulting rates after 1975 would significantly increase lockheed's composite labor rates, and, therefore, labor costs. also, lockheed's best and final offer did not correct the error as alleged since the composite labor rates quoted remained the same.

the seb had two alternatives, either utilize the composite labor rates proposed by lockheed determined by dcaa to be in error, or establish new composite rates from the best information available from dcaa. the seb chose to rely on dcaa to establish the starting point for purposes of applying escalation (nasa's term used in the evaluation - see the above discussion on escalation) of 5 percent as proposed by lockheed and modified downward for staffing variances.

lockheed's overhead and general and administrative costs

lockheed states that when the seb adjusted its direct labor costs upward, the seb applied the same overhead and slightly adjusted g&a rates to the new higher labor costs. lockheed contends the seb's position represents an incompatible set of conditions in that if labor costs are increased, overhead and g&a rates must be decreased.

in this regard, it is claimed, the increased labor cost would not affect certain fixed overhead costs (taxes and insurance); therefore, the method employed by the seb resulted in a cost penalty to lockheed of $20.4 million ($ry). the seb did, in essence, apply the lockheed proposed overhead and g&a rates, which were approved by dcaa, to lockheed's adjusted direct labor cost without adjusting the rates downward.

lockheed's contention is supported by accounting principles. however, lockheed's proposal did not contain sufficient data from which new lower overhead and g&a rates could be developed to the adjusted direct labor cost. moreover, although thiokol's proposal did furnish information to adjust thiokol's overhead and g&a rates, the seb, to keep the proposers on a comparable basis, did not reduce thiokol's rates to reflect the increased direct labor costs. the procedure employed by the seb was consistently applied to all proposers.

thiokol's composite labor rates

with respect to thiokol's labor rates, the seb essentially adopted a dcaa audit report. dcaa reviewed proposed labor rates and supporting historical data, evaluated the reasonableness of the escalation percentages, and took no exception to proposed labor rates for increments 1 and 2. based on the dcaa report, nasa accepted thiokol's proposed labor rates through 1975.

dcaa reported to the seb that thiokol used a 5-percent rate of escalation for 1973. the dcaa resident auditor further said the proposed labor force stabilizes in 1979 for the balance of the srm program, and, in a stable employment atmosphere, 5 percent had been experienced by thiokol. thiokol from 1976 forward used a 2 1/2 percent escalation, but dcaa recommended escalation of from 4 to 5 percent annually. the seb, based upon the dcaa audit report, increased to 5 percent thiokol's labor escalation rate from 1976 forward. with respect to thiokol's overhead and g&a, the seb accepted the rates as proposed and approved by dcaa.

conclusion

although lockheed's contentions and gao findings thereon could be elaborated, it is sufficient to state that the gulf coast area hourly labor rates are lower than those in utah. however, the effect of these lower hourly rates are more than offset by lockheed's inclusion in its composite labor rates of higher paid salaried personnel and by lockheed's election to charge these salaried rates to direct rather than indirect labor costs.

under these circumstances and in light of lockheed's errors in its proposal, the seb's use of its own techniques to estimate lockheed's labor cost based, in part, on lockheed's historical data, was not prejudicial to the firm. in any event, the seb's adjustments were significantly lower than alleged by lockheed and also lower than lockheed's recalculated labor costs developed during the latter part of our review.

labor hours

lockheed claims that substantial cost savings result from its proposed facility approach to perform the srm contract. lockheed proposed to construct a new facility tailored specifically to the design, size, and scale of the srm and designed to achieve maximum plant efficiency. thiokol proposed to use its existing wasatch division and nearby government-owned facilities. because of its facility approach and proposed srm design, lockheed contends that manufacturing labor hours for each motor will be substantially less than required by thiokol. specifically, lockheed cited the larger mixers proposed for propellant formulation and the fewer casting segments of the lockheed srm design, and concluded that thiokol would need at least 2.9 million labor hours more than lockheed for propellant processing, motor finishing and inspection. using an estimate of an average labor rate for thiokol, which is higher than that proposed for the gulf coast area, lockheed computed a cost savings of about $48 million ($ry) resulting substantially from the larger mixes and fewer segments.

in its facility evaluation, the seb found no overriding quantifiable advantage to be gained from lockheed's "tailored" facilities. although lockheed received significant credit for its facility approach in mission suitability scoring, the seb concluded that both lockheed and thiokol were effective in minimizing labor hours. the seb found that labor hours for deliverable srm's was about equal for the two proposers and concluded that thiokol had effectively overcome any inherent limitations in its older facility. although lockheed requires fewer mixes due to its larger mixers, thiokol's mix cycle is shorter. the 14,500 pound mixer proposed by lockheed requires a propellant mix cycle of 90 minutes while the smaller mixers proposed by thiokol require only 75 minutes. nasa points out that, although the lockheed design contains fewer casting segments, it contains more case segments. case segments are combined into a casting segment for the propellant processing operations. for example, the lockheed design includes 9 case segments which are combined into 3 casting segments for propellant processing. in summary, nasa stated that the lockheed approach concentrated on achieving greater mechanization of line operations and standardization of the casting segments, while thiokol concentrated on decreased time lines and plant flow times, fewer case segments, and high plant utilization.

direct and support labor hours for srm manufacturing tasks which are an issue in this protest constitute about one-third of the total proposed labor hours, and tasks encompassed by these labor hours are performed almost completely in-house by both parties.

both lockheed and thiokol prepared detailed manhour estimates for each task to be performed and applied learning curves to reflect the efficiency to be gained from repeated performance of the same tasks. in addition, lockheed estimated some tasks using "crew sizing" techniques. labor hours estimated from the "crew sizing" techniques are a function of preestablished equipment capabilities, the number of operators required, and cycle time. historical experience with manufacturing solid rocket motors was used subjectively by both proposers to substantiate their manhour estimates and learning curves.

at the seb's request, the thiokol air force plant representative office (afpro) conducted a review of part of thiokol's support for direct labor hour estimates. the afpro report states that, even though the historical data was accurately presented, labor hour projections were made mainly using judgmental estimates and historical data to test the reasonableness of the projections. the afpro also compared the estimate of overall labor hours for the srm with thiokol's previous labor hours incurred in fiscal year 1972 on the minuteman solid rocket motor program. afpro concluded that, although the proposed labor hours were tight, the srm could probably be produced for the hours proposed.

a similar evaluation of lockheed's proposed labor hours was not performed. instead, the seb relied on its technical evaluators.

in our view, uncertainties exist in the labor hours proposed by both proposers because the estimates necessarily included subjective judgments. in addition, in its best and final offer, lockheed substantially reduced its proposed labor hours without significant substantiation and did not relate the reductions to the work to be performed. the "tailored" facilities, including the larger propellant mixers proposed by lockheed, have not yet been built and therefore resultant efficiencies are speculative.

despite these uncertainties, the seb's acceptance of labor hours as proposed by either lockheed or thiokol was not unreasonable. both proposers used different estimating methodologies to arrive at expected labor hour totals and we were unable to independently verify the accuracy of either projection. the proposals presented a complex assortment of differing designs, efficiencies, and facility approaches and were substantiated to some degree with historical data. although the varying degrees to which the seb attempted to verify the respective proposers' labor hours may have increased the cost uncertainty, examination of the records showed that no prejudice inured to lockheed from the seb's evaluation. in our view, the seb probably should have questioned lockheed's significant learning curve reduction in the best and final offer. lockheed supported the reduction by references, without further substantiation, to supposed lower learning curves achieved on its small solid rocket motor program and two larger solid rocket motor programs of other companies.

lockheed maintains that the seb should have normalized all proposers to thiokol's acceptable schedule risk plan, including a 7-day work week. lockheed's schedule was based on a 5-day work week. we believe thiokol took this approach to overcome the relative limitations in its older facility. to credit lockheed with the thiokol approach would have no more credence than transfusing, for example, lockheed's proposed use of larger mixers to thiokol and evaluating both proposers on that basis. our review has shown that the seb considered the schedule risks of both proposers and we have no basis to question the seb's acceptance of either production schedule.

nozzle costs

lockheed asserts it was prejudiced by numerous seb errors in evaluating estimated nozzle costs of the two proposals.

lockheed contends that thiokol's proposal costs should have been adjusted upward to reflect the real possibility that thiokol would have to convert from low cost nozzle ablative material to conventional, higher cost ablative material. the seb did make such an adjustment. while the exact amount of the adjustment may not be stated, we believe that this adjustment would fall within a range acceptable to the protester.

as to the seb's alleged failure to utilize the lockheed best and final offer in adjusting nozzle costs, the seb did, prior to best and final offers, increase lockheed's nozzle costs, in part, by $14.63 million ($ry) to account for a misapplication of the learning curve for refurbished nozzles. however, upon receipt of lockheed's best and final offer, the seb subtracted its $14.63 million ($ry) figure from lockheed's adjusted costs because lockheed corrected the error and increased its best and final offer by $14.63 million ($ry). thus, the seb utilized only the nozzle adjustment figure stated in the lockheed best and final offer.

lockheed contends that the seb failed to take into account suggested potential savings related to shifting manufacture of the nozzle from the subcontractor's plant in california to maf after increment 1. the lockheed best and final offer suggested a reduction of $19.1 million ($ry) for this relocation, and, in its april 9 submission, lockheed claimed an additional $6.9 million ($ry) reduction because proposed facility construction at the subcontractor's plant would not be required if the nozzle were manufactured at maf.

the gao review found that lockheed's best and final offer did not formally propose nozzle production at maf, but merely listed this plan as an option for cost savings which nasa should accept. lockheed acknowledged that such a shift would require nasa approval in that the assignment of sufficient floor space at maf was prerequisite to any such move. we further note that lockheed did not include any additional costs to be incurred in nozzle fabrication relocation from california to maf after increment 1. the seb was presented the best and final offer on october 15, 1973, just 5 days prior to the final cost evaluation. contained an optional approach which was contingent on the availability of floor space at maf and nasa headquarters assignment of this space to lockheed; it did not provide a complete assessment of, or support for, the suggested savings. the seb did not accept the potential reduction because of uncertainty of space availability, uncertainty of cost savings, and time constraints.

nasa prd no. 70-15 (revised) states that "the contracting officer shall give each offeror a reasonable opportunity (with a common cut-off date for all) to support and clarify its proposal. an offeror may, on its own initiative, revise its proposal and make corrections or improvements until the established cut-off."

we do not take this to mean, however, that the agency does not have the discretion to terminate evaluation of a proposal at some point subsequent to the common cut-off which is reasonable under the circumstances. in an analogous situation in b-176311(2), october 26, 1973, our office concurred in an agency's decision not to reopen negotiations upon receipt of an alternate design proposal in a proposer's best and final offer which contained inadequate data. similarly, in the instant case the seb was not required to evaluate a completely new alternate approach proposed in lockheed's best and final offer since (1) lockheed had presented insufficient information relative to the quantum of savings; (2) the savings were contingent on the availability of floor space at maf and assignment of that space by nasa headquarters; (3) the lockheed potential savings would have had to be reduced by the cost of retooling, requalification, moving expenses, retraining, etc., none of which were readily quantifiable; and (4) there existed substantial time constraints.

lockheed believes the seb should have adjusted thiokol's costs upward by at least $23 million ($ry) to account for thiokol's need to eventually buy the nozzles since thiokol's proposal to fabricate nozzles in-house represented a development of new expertise. lockheed's nozzle contention relative to the thiokol decision to fabricate its nozzles in-house is addressed below where we conclude that thiokol is not developing new expertise. in view of our conclusion, no basis exists to hold that such an adjustment should have been made.

mission suitability evaluation

in the mission suitability evaluation, both lockheed and thiokol were given "very good" adjective ratings on point scores of 714 and 710, respectively, out of 1,000 points. according to the selection statement, the sso noted that the mission suitability scoring resulted essentially in a standoff between lockheed and thiokol. the statement further states that "lockheed's main strengths were in the technical categories of scoring, while they trailed in the management areas. thiokol led in the management areas but trailed in the technical areas, \*\*\*." the sso concluded that "the main criticisms of the thiokol proposal in the mission suitability evaluation were technical in nature, were readily correctable, and the cost to correct did not negate the sizeable thiokol cost advantage."

lockheed claims its superiority in the mission suitability evaluation was greater than the scoring indicates and should have been determinative of award. lockheed alleges that defective evaluation procedures improperly reduced lockheed's superiority and resulted in the seb's determination that the two proposers were essentially equal. it is claimed lockheed should have been selected because of its superiority, particularly in view of the uncertainty of costs as evaluated by nasa. lockheed's superiority in mission suitability is said to have been minimized by (1) an improper and unfair design correction process, (2) granting credit to thiokol for proposal concepts that did not conform to the rfp, and (3) improperly considering a cost factor - early year funding - in the management evaluation.

improper and unfair design correction process contention

lockheed contends that the nasa design evaluation procedures improperly provide for design correction which vitiates competition. the design correction procedures, it is contended, eliminate the necessity for each competitor to respond to those technical deficiencies in its proposal noted by the agency since the seb design team (1) identified design weaknesses; (2) proposed methods of curing the weaknesses and; (3) submitted these proposals to both the manufacturing and cost teams for assessment of the total cost impact of the correction.

as stated above, one of the seb design team's function was to ferret out and note design weaknesses, propose methods for their correction, and refer these matters to the manufacturing team for an estimate of the manning and material required to correct each deficiency. the subsequent data was sent to the cost team for application of labor rates, overhead, material costs and escalation factors as required. the resulting proposed cost adjustment was then presented to the seb for approval and if approved, was integrated into the proposer's cost tabulations. nasa prd no. 70-15 (revised) requires the seb to report to the sso the board's estimate of the potential for correction of the principal weaknesses identified and "the board's estimate of the approximate impact on cost or price that will result from the elimination of correctable weaknesses during negotiations after selection."

lockheed contends that when applied to a design-deficient proposal such as thiokol's the process puts "nasa expertise to work in behalf of thiokol." lockheed further alleges that "the contract nasa had in mind when it selected thiokol is materially different from the contract proposed by thiokol." specifically, lockheed points out that nasa's own reasons for not pointing out design weaknesses during oral or written discussions prior to selection were to eliminate the following undesirable results:

(a) the design correction process results in a leveling process

(b) the proposals as finally evaluated become combinations of efforts of the offerors and the government

(c) independent efforts as the determining factor in the competition are discouraged and diluted

(d) actual or suspected technical transfusion result

(e) there is an obliteration of technical distinctions with a resulting unrealistic emphasis on cost estimates as the decisive factor.

as we stated in b-173677, march 31, 1972, at page 31, the manner of complying with the statutory requirements for discussions in competitive negotiations, set forth in 10 u.s.c. 2304(g), is primarily a matter of judgment for determination by the agency, and that determination will not be questioned by our office unless clearly arbitrary or without a reasonable basis. therefore, as there is no contention as to the unreasonableness of nasa's determination not to have discussions of design deficiencies, we will confine ourselves to an examination of the administration of the nasa design correction process.

it is implicit in the arguments set forth by lockheed that there has been some nasa input into correcting thiokol's proposed design. specifically, lockheed claims that thiokol could not have been selected without the nasa process of "conceiving and evaluating design corrections."

the seb design team had the primary task of reviewing each offeror's proposal for suspected design strengths and weaknesses and the additional task of proposing methods to correct any deficiencies found. distinction must, however, be drawn between these functions. first, each specific design strength and weakness, and the relative magnitude of it, was reported by the design team to the seb as an aid in numerically scoring the proposals in the design area. it should be noted that no seb- corrected design features were submitted to the seb for scoring since only the proposals together with the design team's listing of each proposer's independent design strengths and weaknesses were used in the seb design evaluation. furthermore, the impact of the design team's second function - design correction - went ultimately only to cost adjustment - both directly (e.g., where additional material is required) and indirectly (e.g., where an additional manufacturing step is required to effect the change indicated as necessary by the design team).

the cost proposal of each of the proposers was adjusted for each design deficiency. certain deficiency corrections resulted in a decrease in the proposer's cost. this generally occurred where the proposer had included in its design greater safety margins than the seb deemed reasonably required. however, the more usual impact of proposer deficiency corrections was to increase proposed costs.

lockheed asserts that, under the narrative rating system, thiokol should have been given either a rating of fair or poor in design due to major design shortcomings. in this regard, the source evaluation plan sets out the following:

fair - this rating should be assigned to a proposal that is marginal in meeting rfp requirements. the proposal contains areas of unsatisfactory features although weaknesses can probably be improved during negotiations. strengths in other areas do not offset these weaknesses.

poor - this rating should be assigned to a proposal that contains major unacceptable features which could be expected to provide considerable difficulty to correct during negotiations, if at all.

additionally, the source evaluation plan provided that a proposal which contained major technical or business deficiencies, omissions or out-of- line costs may have been considered unacceptable prior to final evaluation. in that event evaluation could be discontinued.

lockheed asserts that the sso's selection statement establishes that the thiokol design deficiencies were major and not readily correctable.

the pertinent portion of the statement says:

the thiokol case design met the general srm requirements; however, the cylindrical segment (for alternate water impact loads) was close to the upper limits of size capability of the case fabricator. the nozzle design included ablative materials not currently developed or characterized. this offered potential savings in program cost, but with attendant technical and program risk. an expanded characterization and development program would be required. the thickness of the nozzle material was insufficient to meet required safety factors and thus degraded reliability. the amount of material required to correct the deficiency was substantial and the deficiency could require a redesign of the metal portions as well as the ablative portions. the design was complex and would contribute to difficulty in manufacturing. the thiokol motor case joints utilized dual o-rings and test ports between seals, enabling a simple leak check without pressurizing the entire motor. this innovative design feature increased reliability and decreased operations at the launch site, indicating good attention to low cost ddt&e and production. the thickness of the internal insulation in the case aft dome was marginal and created a technical risk.

lockheed also maintains that:

nasa diminished the extent of the thiokol design deficiencies by labeling them readily correctable weaknesses and of minor cost impact. for a solid propellant rocket motor, a minor change to any major component such as the nozzle has major impact on the other components and in the total motor design.

it is true, as noted by the sso, the seb and the design team, that there were deficiencies in the thiokol design. nevertheless, we do not feel that the thiokol proposal contained major design deficiencies.

pursuant to the sense of the source evaluation plan, major design deficiencies envisage only those weaknesses which have a significant impact on the srm's ability to perform acceptably within the rfp parameters and are not within, or are marginally within, the proposer's capability to correct in a time frame consistent with project milestones. deficiencies of the magnitude noted above clearly are not readily correctable by the proposer and may not be correctable. accordingly, any projection of correction cost of a major design deficiency would be an exercise in uncertainty, with a resulting degradation of the viability of the entire evaluation process. additionally, a major design deficiency would clearly imply that, in the absence of an input of nasa expertise, the proposer could not readily modify its design so as to have it considered acceptable.

while we note the impact of both the quantity and the significance of thiokol's design deficiencies, we do not feel that any single deficiency, or even the weaknesses taken as a whole, can fairly be categorized as major design deficiencies so as to cast doubt on the propriety of the seb design evaluating correction process. we agree with lockheed that "it is improbable that nasa could have selected a proposal per se with major technical weaknesses \*\*\*" and we conclude that nasa did not do so.

thus, with reference to specifics of the thiokol design - the proposed use of low-cost ablative material in the nozzle; the inadequate thickness of thiokol's proposed nozzle material and possible design repercussions thereof; the complexity of its nozzle design; and the marginal thickness of its internal insulation in the case aft dome we feel that the nasa design evaluation correction process could have functioned effectively. precisely, both the design team and the seb characterized thiokol's low- cost material as a design weakness of some import and made a cost adjustment for additional developmental testing deemed necessary to allow for the possible use of this low-cost material and made another adjustment relative to the contingency that only conventional material (a thiokol proposed alternate approach) could be used. the inadequate thickness of thiokol's nozzle material also resulted in an evaluated weakness with cost impact. furthermore, thiokol's nozzle complexity was established as a weakness both in design and in manufacturing as the thiokol nozzle design was considered to be one of the most difficult of the nozzles proposed to manufacture. an adjustment to the appropriate thiokol learning curve was made by the seb to more accurately reflect this difficulty of manufacturing the thiokol nozzle. of course, this adjustment to the thiokol learning curve had the additional effect of increasing the number of man-hours required to manufacture the nozzle and hence the cost of manufacture.

with regard to the allegedly inadequate and unproducible thiokol design for a case meeting alternate water entry load conditions, we note that the rfp asked offerors to address in a "special topic" how they would modify their baseline case designs to assure that the case could survive an ocean splashdown of greater force than contemplated in the baseline approach. in its proposed alternate water entry load condition design, thiokol suggested the use of certain segments whose design configuration size requirements exceeded the case fabricator's capacity to manufacture the segments.

the seb, after assessing a weakness against thiokol in manufacturing, recognized that the problem could be solved by either a major case redesign utilizing a greater number of smaller segments, a utilization of ingots larger than those currently being produced, or through a redesign of the segment to optimize material utilization while maintaining the structural properties required to meet the alternate water impact loads. however, no cost adjustment was made for the correction of this deficiency or any deficiency in this area to any of the proposers since the seb felt that the problem which it had posed as a "special topic" was merely intended to give the government insight as to how the proposer would design its case should these specific water impact factors become a program requirement. the special topic was apparently meant to be primarily a further test of the proposer's design and manufacturing abilities, and was not "costed out" since the necessity for, or the parameters of, a case to meet the precise special topic conditions was at that juncture uncertain. moreover, seb records confirm the nasa report in that thiokol included in its early development schedules and planned tasks a design period for incorporating design changes if and when they would be required in this area.

the seb gave thiokol's proposal weaknesses both in design and in manufacturing because its complex nozzle contained a large number of parts which would not lend itself to easy fabrication. on the other hand, for its submission of an unmanufacturable alternate case, thiokol was given a deficiency only in manufacturing for its response to the alternate water impact load.

since the failure to submit a readily producible end product is likewise a design error which leads to problems in manufacturing, we believe that the seb, consistent with its evaluation of nozzle complexity, should have assessed thiokol with an additional weakness in design. we note that, in another area, thiokol was assessed favorably in both design and product support for its proposed use of a certain type and design of case segment seals. consistency would seem to require that design details which impact on manufacturing, refurbishment and/or product support should be reflected, either as strengths or weaknesses, or both, in design and in the other areas affected.

we therefore question the seb's failure to assess thiokol a weakness relative to alternate case design. moreover, where the design team has recognized as a weakness the fact that thiokol proposed the use of a certain type of metal for parts of the nozzle which could have an impact on the refurbishability of these parts, it would appear that a concurrent notation of weakness would also become necessary in refurbishment.

while we question the above-noted omissions, we are unable to quantify the impact, if any, of the inclusion of these deficiencies on the scorings in mission suitability at that time. even if the mission suitability scoring should have been adjusted on the basis of the seb omissions to increase the present four-point spread between lockheed and thiokol, we do not believe that the impact would be of sufficient significance to distinguish this situation from those instances where the question of whether the given point spread between two competing proposals under the circumstances presented indicates the significant superiority of one proposal over another. this is primarily a matter within the discretion of the procuring agency. see 52 comp. gen. 686 (1973).

moreover, we find that the seb scoring reflected the weaknesses found in thiokol's proposal and all other proposals and, as the nasa report states, "the lockheed proposed design was determined to have significant advantages over thiokol's proposed design." the seb was charged, and did report, to the sso the correction potential of principal proposal weaknesses and the cost or price impact resulting from the elimination of these weaknesses after selection in accordance with the nasa prd. therefore, in the light of the uniformity of treatment between proposers, we find that the design correction process was in conformity with nasa procedures and was not improper or unfair. moreover, the omissions in the design evaluation do not cause us to conclude that lockheed should have had a greater scoring edge or that the omissions detracted, in the overall, from the seb's conclusion that both firms were essentially equal in mission suitability.

credit for nonconformance to rfp contention

lockheed objects to the seb giving thiokol affirmative credit for proposal concepts not conforming to the rfp. lockheed views thiokol's decision to fabricate the critical nozzles in-house to be in direct contravention of the following rfp provisions:

nasa considers that a prime contractor's use of established expertise in the private sector is an essential approach toward the objective of maximum economic effectiveness. proposals from joint ventures will not be accepted, and the development of new expertise by a prime contractor, either in-house or elsewhere in the private sector, is to be avoided to the extent possible, since the latter course detracts from the stated objective.

\*\*\* in order to meet the objective \*\*\* (in the above quote) to achieve maximum economic effectiveness, proposers should seek to maximize the use of existing expertise in establishing make-or-buy plans.

these provisions, together with the selection statement's finding that thiokol had a "lack of experience in fabricating nozzles of this size," in lockheed's opinion, supports its objection. it is claimed that the nasa report rewrote the selection statement by stating that "the seb's opinion was that thiokol's proposal to build the nozzle in house did not represent the development of a new expertise but capitalization on existing expertise."

the affirmative credit for thiokol's nozzle decision appeared in the evaluation of management factors which formed a part of the rationale of the selection statement.

the tentative decision to make the molded and tape wrapped nozzle in house was considered a strength in this area. it would contribute to the low cost-per-flight goal by using available resources, avoiding subcontract fees, lowering overhead rates, and taking advantage of lower cost labor. the inherent risk management aspects were also considered.

moreover, lockheed points out, and the nasa report confirms, that the above decision was considered a plus under the management factor. lockheed argues that there should be no merit given to a proposal concept which deviates from the rfp. therefore, credit for this "nonresponsive" aspect of the proposal from the management and cost standpoints compounds the offense against the rfp since it instructed offerors that use of established expertise with the resulting minimization of risks was essential to maximum economic effectiveness.

lockheed maintains that thiokol lacks experience in fabricating nozzles, particularly nozzles of the size and quantity necessary to satisfy the product or requirements of the contract. lockheed contrasts the thiokol limited experience to the extensive experience of several qualified vendors on production programs and on large development nozzles.

we questioned nasa and thiokol on the extent to which thiokol and other fabricators have expertise in nozzle production. we also examined thiokol's proposal and the seb records. we conclude that no nozzle manufacturer has fabricated nozzles in a production program in any way comparable to the size, type, and quantity required for the srm. this observation is supported by the following passage from a letter of may 13, 1974, to lockheed from a qualified nozzle vendor stating in part:

since a nozzle production program comparable to the srm in size, complexity, duration, and delivery requirements has not been accomplished to date, actual cost curve data is not available.

therefore, it appears that whichever "experienced" nozzle fabricator would produce the nozzle, some development of new expertise and a new experience base would be required.

the selection statement reference to thiokol's lack of experience in fabricating nozzles of this size was as follows:

a minor weakness in the manufacturing approach was the decision to fabricate nozzles in-house due to thiokol's lack of experience in fabricating nozzles of this size.

a review of thiokol's proposal, the seb records, and the supplementary data submitted supports the seb's conclusion that thiokol possesses basic expertise and experience in the fabrication of nozzles. we are particularly impressed by thiokol's (1) fabrication experience with flexible bearings - a key component in the srm nozzle; (2) extensive nozzle design participation; (3) manufacture of various small nozzles and plastic nozzles; and (4) experience in poseidon and trident test nozzles, as well as anticipated production follow-on contracts which are expected to be completed before the srm nozzles are scheduled for fabrication.

in view thereof, we find a reasonable application of judgment by the seb in treating thiokol's nozzle size experience as only a minor weakness in manufacturing. while some vendors might have more production experience with nozzles larger than those previously manufactured by thiokol, we cannot say that nozzle fabrication by thiokol would represent the development of new expertise. in any event, the rfp did not prohibit the development of new expertise, but provided that new expertise "is to be avoided to the extent possible." therefore, we believe that thiokol's decision to fabricate the nozzle in-house did not deviate from any rfp requirement. consequently, the credit given for this cost-saving decision by the seb in management evaluation appears proper. in any event, the seb records reveal that the thiokol nozzle decision, while rated a management strength, was not among the principal reasons for thiokol's significant advantage attained in the management evaluation.

lockheed further asserts that the thiokol decision to utilize in its design unproven low-cost nozzle ablative material was a clear deviation from the rfp's overall objective of "achieving a minimum development risk and highly reliable design." the fact that thiokol's use of these low- cost ablatives was viewed by the sso as a significant design weakness with concomitant cost implications is taken to support the allegation that thiokol's decision to use low-cost materials increased risk and decreased reliability.

we might be inclined to agree with lockheed but for the fact that thiokol recognized the developmental risk and proposed a parallel development effort based solely on the use of conventional material. in fact, thiokol contemplated the possibility that within the early phase of the contract the use of low-cost ablatives would not prove feasible, and that conventional materials would be required. the seb adjustment of thiokol's costs to be incurred as a result of any change over does not detract from the fact that thiokol proposed both an approach containing some risk and a low-risk alternate program to which it could convert.

early year funding and the management evaluation

with regard to the management evaluation factor, the scoring difference between lockheed and thiokol was minimal on key personnel, but thiokol scored significantly better than lockheed on management approach and organization. this overall thiokol superiority in management contributed greatly to the virtually equal mission suitability scores of the two proposers.

the rfp provided that:

evaluation under this criterion (management approach and organization) will be the proposer's management effectiveness in achieving project goals and requirements, the overall logic, approach and organization selected for this procurement, and methods for management control and integration. the thiokol advantage in management approach and organization resulted from two significant strengths - low programmatic risk and low early year funding - in direct contrast to lockheed's two significant weaknesses - high programmatic risk and high early year funding. lockheed cites the following passages from the selection statement which, it is alleged, demonstrates the impropriety and unfairness of this evaluation in regard to early year funding:

the new facility approach (of lockheed) resulted in high early year funding which is contrary to one of the key project goals.

\* \* \* \* \* thiokol structured the development program so that all major costs were deferred to the latest practicable date. this resulted in low early year funding, which is a key program objective.

thiokol had the most favorable cost posture in the facility area due to the fact that the additional facility capability required was minimal in comparison with the other proposers. this has the effect of minimizing early year funding requirements which is one of the srm program goals.

simply stated, lockheed's high early year funding stemmed in large measure from its substantial construction of new facilities funded by the government in the first few years of the program.

lockheed argues that the seb's reliance and inordinate emphasis on early year funding to detract from lockheed's management and therefore mission suitability scoring is a deviation from the rfp's emphasis on the total program cost benefits of the various proposals, exemplified as follows:

evaluation of proposals will be accomplished in accordance with provisions and procedures described in section i and ii of this rfp, and will be based on each proposer's proposals for the entire project duration rather than on any particular segment or increment thereof.

while acknowledging rfp references to "early year funding constraints," lockheed contends that they are never stated apart from the long range costs, never referred to as a primary objective or evaluation factor, and constitute a minimal percentage of total program cost. furthermore, lockheed questions the infusion of this particular cost factor, but not others specified by the rfp such as the cost risk of thiokol's marginal design, into the management evaluation.

in rebuttal, nasa points to the general knowledge throughout the industry of its desire and need to minimize early year funding as space shuttle and srm program goals. on at least three occasions, lockheed representatives attended preproposal space shuttle quarterly reviews where early year funding restrictions were stressed. nasa states that lockheed was warned that its facility approach resulted in a tight schedule because of the unavailability of facility funds in an early fiscal year.

moreover, nasa refers to several rfp provisions specifically encouraging minimization of costs consistent with early year funding constraints and requirements. based on the above, nasa contends, it cannot fairly be stated that early year funding was a secondary, subordinated or incidental matter relative to other goals and requirements. as a project goal, nasa believed that it would have been negligent had it not evaluated the early year funding posture of the proposals under the management approach and organization criterion of the management evaluation factor as to the "proposer's management effectiveness in achieving project goals and requirements \*\*\*." while lockheed denies that its early year funding requirements are any higher than thiokol's, our examination of the seb's cost evaluation supports nasa's judgment to the contrary.

lockheed's characterization of early year funding as an unimportant matter or a mere constraint is not borne out by a review of its proposal. lockheed proposed facility modifications and new construction to be modular with facilities added only as required to meet production rates necessary to accommodate the flight schedule. lockheed stated that: "only essential buildings will be constructed during ddt&e to minimize funding requirements during the early phases of the program." moreover, the fact that lockheed viewed this early year funding "cost" factor as a proper subject for management consideration is amply demonstrated by this statement from its management proposal:

lockheed propulsion company proposes to meet the demanding cost challenge and technical responsibilities of the space shuttle srm in a fully responsive manner. to accomplish this, our corporate management makes the following commitments.

to apply a management plan that incorporates our proven systems and techniques for effective program systems and techniques for effective program direction and control leading to low early year funding and lowest cost per flight.

in view of the above, we find no fault with the seb's treatment of the high early year funding feature of the lockheed proposal in its evaluation of the rfp's management factor. moreover, with respect to the cost implications of thiokol's marginal design in management, we believe that, as previously discussed, thiokol was adequately penalized in design and by upward adjustments to its proposed costs by the seb.

the seb judged the thiokol proposal to offer a low programmatic risk because of intended utilization of existing facilities with a mature, stable, in-place organization. in comparison, lockheed, to complete the project, would have to accomplish simultaneously the following three activities: (1) build a multimillion dollar facility at the mississippi test facility (mtf), in 1974 and 1975 with a schedule considered overly optimistic by the seb; (2) relocate, without a logistics plan, the entire lockheed project team from california to mtf during 1974 and 1975; and (3) increase the mtf work force by 88 percent in 1975 and 43 percent in 1976.

three independent evaluations of lockheed's proposed construction schedule were performed by the seb. each evaluation reached the same conclusion - lockheed's mtf construction schedule was unrealistic and probably would not be met. lockheed presented studies that independently evaluated the mtf construction schedule as accurate and reasonable. the end, the seb followed its own judgment and expertise, and, although penalizing lockheed in the management scoring, assessed no cost penalty for the scheduling problem.

we found no evidence indicating a dissenting opinion within the seb on the construction schedule decision. also, a review of the seb scoring by individual members, including secret ballots, showed a strong consensus in the management approach and organization criterion which took this crucial matter into account. we are, therefore, not in a position to say that the seb's judgment in this area lacked a reasonable foundation.

in general, we found that the documentation supports the significant findings of the seb in the management area. lockheed believes that thiokol's deficient design and other proposal decisions which purportedly increase project risk should have resulted in a penalty against thiokol in the management category. this fails to recognize the substantial penalties from both a mission suitability and cost standpoint (discussed elsewhere) assessed against thiokol in evaluated areas other than management. moreover, we cannot say that thiokol's design deficiencies and other program development risks warrant a management penalty for failure to achieve project goals.

in sum, we do not find a basis to conclude that lockheed's alleged superiority was improperly reduced by virtue of defective evaluation procedures. in our judgment, there is a reasonable basis for nasa's conclusions that lockheed and thiokol were essentially equal in mission suitability.

other factors evaluation

lockheed contends that nasa improperly ignored the feasibility of competition for increment 3 as a factor, thereby depriving lockheed of superiority in the "other factors" evaluation. as stated above, the rfp advised that proposals would be evaluated in accordance with eight stipulated "other factors" not numerically scored. these factors, according to the rfp, "have been identified as being such that they bear on a proposer's ability to meet the requirements and objectives of this procurement and will be considered by the source selection official." this contention deals with the following "other factor" which, it is claimed, nasa did not properly take into account in the evaluation process:

facilities. flexibility inherent in the proposed facilities plan and its adaptability to nasa's plan to separately contract for increment 3.

it is contended that lockheed's facilities plan makes competition feasible in increment 3 by providing complete government-owned facilities available for all potential competitors to use. lockheed quotes from the selection statement as supportive of its argument that performance of increments 1 and 2 at the thiokol plant makes it economically impracticable for any other firm to compete for increment 3 without significant added costs to nasa and writes off the possibility of increment 3 competition.

in regard to the economics proper, the board's evaluation made it clear that such an investment could not at this time, under any reasonable view of the forecasted economic factors, be considered likely to pay its way as against thiokol's existing facility. as regards other considerations, we recognized that it may well be advantageous, when the major production phase arrives, to plan to have two or more suppliers in the country capable of competing for the manufacture of srm's in quantity; however, there is no need to embark upon the construction of a new major facility at this time in order to secure these benefits in a timely manner.

in addition, lockheed argues that increment 3 competition cannot be obtained without significant facilities investment as the selection statement anticipates from the underlined portion of the above quote. therefore, it is claimed that - even assuming that nasa was not required to give lockheed significant credit in the evaluation - the cost of obtaining increment 3 competition should have been evaluated and assessed against thiokol.

the selection statement acknowledged that lockheed's facility plan enhanced beneficial competition for increment 3. the statement accurately reflects the findings of the manufacturing team and a subpanel of the management team on this matter. in fact, the manufacturing team included the matter in its formal evaluation of the lockheed proposal which, it appears, contributed to the lockheed scoring advantage under that rfp criterion.

the seb record reveals that no significant discriminators were developed in evaluating facilities flexibility. the seb found that all proposed incremental facility plans of the competitors provided flexibility to a varying degree. more specifically, the sso was advised that all facilities plans could accommodate competition in increment 3, a reduced launch rate, and a second source for increment 3. the seb further noted that all proposers except thiokol had a feature providing for another proposer to take over production in a government plant in the third increment.

also, the seb reported to and the sso considered a closely-related "other factor," raised on the seb's initiative, of facility cost effectiveness where a comparison of benefits and costs was done in several areas taking into account transportation and maintenance. as the selection statement reports, lockheed's favorable transportation and maintenance position did not extinguish its high facility expenses over the life of the program.

the varying degrees of facility flexibility among the proposers were preserved through the seb's consideration of this "other factor." the record shows that seb evaluators considered thiokol's facility plan to offer a significantly lesser approach to beneficial competition in increment 3. however, according to nasa, a completely government-owned plant is not prerequisite to a separate procurement for increment 3. all proposers except lockheed possess differing amounts of facilities which, with some expansion, could support increment 3 production requirements and have sufficient sales bases to maintain an operating status through the beginning of increment 3. lockheed's own facilities plan would include several million dollars in undepreciated equipment which would have to be accounted for prior to production competition.

moreover, we note that construction of the bulk of the facilities needed for a government plant to perform increment 3 can be delayed until about 1979 or well into increment 2. utc premised its proposal on such a basis, and even the majority of thiokol's facility expenses might be incurred at a new location in the southeast as late as 1980.

of particular significance, we note that this "other factor" does not preclude the possibility of a sole-source procurement or the division of the production increment into two sources. the circumstances extant at the beginning of increment 3 will dictate the most advantageous course for the government to follow. the options which will be available to nasa coupled with the multiple facilities postures of the principal solid rocket motor contractors, in our view, negates meaningful quantification of any costs being assessed for or against thiokol, lockheed, or, for that matter, any other firm in the competition. finally, we note that the sso might very well have found discriminators in favor of thiokol in the "other factors" evaluation. based on the above, we find no unreasonableness or unfairness in the sso's consideration of the facilities flexibility "other factor." interim contracts

lockheed has also protested both nasa's award to thiokol on a sole source basis of an interim contract and the extension of that contract. the contract in question calls for studies, analyses, planning and design relative to integration of the srm with the entire space shuttle system.

lockheed asserts that there has been or will be a transferal or transfusion of its superior design through the correction and revision of thiokol's design. moreover, the protester claims that whether or not the specific lockheed design has been transfused, nasa is spending money on work which is meant to merely improve thiokol's design and cannot therefore benefit lockheed in any way because lockheed already has a superior design.

in our decision regarding a similar interim contract issued pending the protest of the award of the space shuttle main engine contract, we did not question the award even where:

\*\*\* nasa concedes that because of the work done under the interim contract rocketdyne (nasa's proposed contractor) has refined its design and retained an experienced staff. therefore, it is expected that rocketdyne would be in a position to prepare a better proposal in the event of further competition. \*\*\* (b-173677, december 29, 1971.)

we concluded there that since the work was within the general scope of rocketdyne's proposal and "much of it could possibly be of use to other competitors," there was no basis to disturb the award of the interim contract.

in the present situation nasa did, however, state in its justification for the sole-source award that, "the results of the contract effort, in addition to being critically needed by nasa and the other space shuttle major prime contractors, will be of value to whoever is selected as the solid motor contractor."

our office has examined the work done under the study contract and has concluded that no technical transfusion has occurred in the sense that thiokol has obtained the advantage of lockheed's "superior design." think it is important here to note that technical transfusion is normally used to connote the transfer of a unique concept from one offeror to another with the result that the latter's proposal receives an evaluation advantage based on the former's ingenuity. for reasons which are readily apparent, such transfusion would be patently unfair and should be scrupulously avoided in a procurement of this kind. since the evaluation process has been concluded, we employ the term "transfusion" in a more general sense - as we assume that lockheed's counsel did - to mean the receipt of an advantageous idea which might otherwise not have occurred to the recipient.

specifically, we feel the development through the interim contract of a new baseline design, geared for the nasa dictated angled srm water entry (similar in nature to that stated in the rfp special topic regarding alternate water impact loads) came about as a natural design evolution. in establishing the new baseline thiokol did not appear to have or need any technical transfusion. the use of essentially shorter and thicker segments than contemplated in the original baseline configuration appears to be an elementary solution to the problem of providing the greater strength necessary for the case to withstand the greater forces to which it would be subjected. therefore, we do not see any basis for concluding that any technical transfusion has occurred in this regard. moreover, the data that has been generated as a result of more specific delineation of the seb operational parameters, much of which could be made available to other competitiors, should be of value to all participants in any further competition.

in one instance nasa asked thiokol to perform a study task which is of no appreciable benefit to any other proposer. in the area in question only thiokol proposed design approach "a," about which the seb had some doubt, while all other proposers offered design approach "b," yet thiokol was asked to study the possible use of approach "b." however, on the whole, nasa has generally adhered to the statements made in its justification. since we have found no attempt either to transfuse technology or allow thiokol to enhance its design to the disadvantage of any other proposer, we cannot object to the interim contracts. we recommend that all proposers, consistent with the rules regarding proprietary data, be furnished the maximum amount of useful information generated under the interim contracts.

conclusion

in considering the results of the seb evaluation presented to him, the sso, in his selection statement, first noted that the mission suitability scoring resulted essentially in a stand-off among lockheed, thiokol, and utc. the sso agreed with the seb's conclusion that "thiokol could do a more economical job than any of the other proposers in both the development and the production phases of the program; and that accordingly, the cost per flight to be expected from a thiokol built motor would be the lowest." in addition, the sso noted that "a choice of thiokol would give the agency the lowest level of funding requirements for srm work not only in the overall sense but also in the first few years of the program." he concluded "that any selection other than thiokol would give rise to an additional cost of appreciable size." he further noted that the extensive facilities investment needed by lockheed could not, under any reasonable view of the forecasted economic factors, be considered likely to pay its way against thiokol's existing facility. found no other factors bearing on selection ranking in weight with the above. he concluded "that the main criticisms of the thiokol proposal in the mission suitability evaluation were technical in nature, were readily correctable, and the cost to correct did not negate the sizeable thiokol cost advantage." as a result, the sso "selected thiokol for final negotiations."

in support of the stated basis for selection, the nasa report invites our attention to the following passage from our decision at 50 comp. gen. 246, 249 (1970):

where\*\*\* two offerors are essentially equal as to technical ability and resources to successfully perform a research and development effort, the only consideration remaining for evaluation is price. in such a situation, we believe that the lower priced offer represents an advantage to the government which should not be ignored.

as is evident from our conclusions set forth above, we found no overriding basis to disagree with the sso's reliance on the virtual equality of lockheed and thiokol based on the seb's evaluation of mission suitability and other factors. therefore, it becomes necessary to discuss lockheed's allegation that making a selection decision on the basis of admitted uncertain cost proposal estimates covering a 15 year contract period is violative of the governing procurement regulation, nasa pr 3.805 -2 which provides as follows:

in selecting the contractor for a cost-reimbursement type contract, estimated costs of contract performance and proposed fees should not be considered as controlling, since in this type of contract advance estimates of cost may not provide valid indicators of final actual costs. there is no requirement that cost-reimbursement type contracts be awarded on the basis of either (a) the lowest proposed cost, (b) the lowest proposed fee, or (c) the lowest total estimated cost plus proposed fee. the award of cost-reimbursement type contracts primarily on the basis of estimated costs may encourage the submission of unrealistically low estimates and increase the likelihood of cost overruns. \*\*\* the primary consideration in determining to whom the award shall be made is: which contractor can perform the contract in a manner most advantageous to the government.

the rfp placed considerable emphasis on the importance of constraining cost to reflect one of the primary objectives of the space shuttle program - reduce substantially the cost of space operations. innovative ideas in design, engineering, production, and management were sought to achieve minimum production and operational costs at reasonable development costs and to provide assurance that the proposed cost will not be exceeded. this end, proposers were advised it is imperative that effort be made to minimize production and operating costs while maintaining reasonable development costs. design and production approaches were to be utilized that would result in the lowest possible cost per flight consistent with early year funding constraints and design, performance, and reliability requirements. mission suitability ratings were to be determined substantially by anticipated contributions to low production and low operating costs.

proposals were to be evaluated on those factors indicating the adequacy and realism of the cost proposals and the probable costs that will be incurred. included in the evaluation was an assessment of the cost of doing business with each proposer and possible cost growth during the course of the program. while not numerically scored, these factors were to be reported by the seb to the sso. the importance of the criteria was made dependent on such considerations as the magnitude and credibility of the cost differentials, the keenness of competition in mission suitability and impact, if any, of other factors. the cost proposal was to be used extensively in the evaluation and scoring of mission suitability factors to determine realism, understanding of requirements and whether the design and production approach being taken would lead to lowest production and operational cost consistent with reasonable development cost.

from the above, it is clear that nasa apprised all offerors of the significance and relative importance of cost, and was obligated to evaluate the cost proposals submitted. we find no conflict between the rfp cost evaluation criteria and nasa pr 3-805.2 which, in our view, was intended to preclude undue reliance on proposer cost estimates in a cost- reimbursement procurement. the regulation does not preclude consideration of cost projections verified or proposed by the government; in fact, they may become controlling if all other factors are substantially equal. comp. gen. 686, 689 (1973).

of course, consistent with the rfp, the seb reasonably had to assess the cost realism of the proposals, the estimated cost differences between proposers, and the probable costs that would be incurred to reflect the possible growth of cost over the term of program. 52 comp. gen., supra.

we reviewed the nasa cost evaluation process in terms of assessment of cost realism and most probable costs. we do not find it necessary to relate the details of the source evaluation plan developed by the seb for evaluating cost proposals. it is sufficient to say that the seb, particularly through its cost team, conducted extensive analyses and sensitivity studies into cost realism and most probable cost in arriving at its conclusion that thiokol would be the probable low cost performer of the srm contract by $122 million ($ry).

the seb started from the proposed costs. taking into account the construction of facilities funding and government support required by lockheed, thiokol's proposed costs were lower than lockheed's by about $95 million. to comport with nasa prd 70-15 (revised) which requires the seb to report to the sso the approximate impact on cost or price that will result from the elimination of correctable weakness in proposals and other pricing adjustments, the seb then employed an adjustment process. the seb further performed analyses of cost uncertainties still remaining in proposals where adjustments could not be fully substantiated. as the nasa report states:

in summary, the board made adjustments in a proposer's cost where adequate substantiation and/or rationale was found. for items which "looked low" but for which an inadequate historical basis existed from which to estimate an adjustment, or for items where, in the seb's judgment, the most probable program outcome did not indicate the cost would likely be incurred, adjustments were not made. uncertainty analyses were conducted to determine a probable range of uncertainty, as well as to determine if there were significant differences in uncertainty of the "most probable" cost among the proposers. no significant differences in the uncertainties among the proposers were noted. though analytical techniques were utilized in some of the uncertainty analyses, the final position taken by the board can be best described as subjective judgment tempered with advice of knowledgeable key individuals.

normalization of proposals to common cost baselines directly or indirectly resulted in adjustments because there was no logical reason for differences or because the proposals did not contain sufficient information and "should have bid" estimates were prepared. we have examined the seb's "quantifications" of the uncertainties and agree that the seb's evaluation showed that the uncertainties balanced out. also, the adjustments made by the seb for both lockheed and thiokol were within the same range, as reflected by the $122 ($ry) difference in favor of thiokol after adjustments. an adjustment was approved only upon agreement of all 13 seb members.

according to nasa, the uncertainty analyses were conducted to test if the most probable cost difference fairly represented the respective proposals and the relative standing of the proposals. uncertainties evolved from areas where confidence was low in the proposal estimate but a valid basis for adjustment could not be found, or where the seb's confidence in internally generated estimates was no greater than in the proposal. to a large extent, the seb used government estimates, proposer to proposer variations, and subjective judgment in the various areas examined. the seb reported to the sso its estimate of the most probable costs, a detailed analysis of the adjustments made, and its methodology of uncertainty analysis along with the typical uncertainties in most probable cost for each proposer. the seb also reported: all three approaches indicate approximately same range of uncertainty for all proposers ($300k- $400k) in cost per flight.

the seb relied on the uncertainty balance to attest to the real differences in cost which might be expected to occur depending on which proposer performed the contract.

based on our examination and review of the seb adjustment and uncertainty evaluation as reported to the sso, we find no basis to question the seb's procedures and methodology in its assessment of the realism of costs. while the seb relied to a great extent on the proposal estimates submitted and took a conservative approach in adjusting the proposals, our review of the process found no unreasonableness or unfairness in the process itself. had the seb relied solely on the estimated costs, we would question the reliability of the evaluated cost differences. however, an adjustment evaluation and an uncertainty analysis were superimposed on the proposed costs. our review of the cost evaluation upon which the sso based his decision confirmed the seb's conclusion that uncertainty in varying degrees in probable cost of performance would occur, and for different reasons, among the proposers. also, we found additional uncertainties which, where "quantifiable," did not favor one proposer over the other. to the extent that cost realism and most probable costs can be predicted over a 15-year period, we found the cost evaluation process to adequately and fairly reflect anticipated differences in costs. except for one area, we found the evaluation to have been performed reasonably.

in view of our findings in the ammonium perchlorate area, we believe that the sso should determine whether the validity of his selection is materially affected by the substantial reduction in the cost difference. a proper and reasonable evaluation of ap would have reduced by about $68 million ($ry) the most probable cost difference as evaluated by the seb and reported to the sso. in addition, as already noted, nasa has admitted to understating thiokol's transportation costs by about $6 million ($ry). moreover, the sso may also wish to consider whether lockheed's labor costs should be increased by about $15 million ($ry) over the seb's evaluated labor costs with adjustments in light of our previous discussions in the labor rate area. we note that, in a prior statement concerning the selection of a contractor for another component of the space shuttle system via a cost-plus-award-fee contract extending over a 7-year period, the sso stated:

as a result of adjustments to the proposed costs made by the board as part of its evaluation, pratt & whitney's cost were considered the lowest. the estimated costs for the three contractors, both as proposed and adjusted are within the range of uncertainty that is inevitable in estimating for cost-type research and development contracts, in which the period of performance extends over many years. (quoted from b-173677, march 31, 1972, at page 4.)

the cost estimates in that selection (the government estimate was $851 million) were within an 8 percent range and, in not selecting pratt & whitney, the low cost proposer, for award the sso stated: "\*\*\* it was evident that the technical competition was close and that the estimated or adjusted costs did not give any of the proposers a significant advantage."

by referring to the prior selection, we do not intend to question the sso's reliance on costs here; projected costs were obviously and properly a significant factor. each procurement must be awarded in consideration of the attendant facts and circumstances. however, that selection statement indicates that the sso looked to whether estimated or adjusted costs gave any proposer a "significant advantage" where, as here, technical competition is close.

we recognize that the selection remains the function of the sso. our role is to test the reasonableness of the result. however, the circumstances appear to call for the sso to determine whether the net significant decrease in the probable cost difference between the proposals of thiokol and lockheed, in light of the four point difference in mission suitability scoring, calls for a reconsideration. in the event the sso determines that a reconsideration is called for, the proposals of each should be considered as they and the attendant circumstances existed as of the time of the original selection decision except for the above-stated difference in probable cost.

by a separate letter of this date, we are drawing the attention of the nasa administrator to our recommendation and requesting that we be advised of the actions taken as a result thereof.

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