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Report to Rep. John J. McFall; by Robert F. Keller, Acting Comptroller General.

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The F-18 aircraft prime contractor, McDonnell Douglas Corporation, awarded subcontract to Martin-Baker Ltd. (M-B) a British firm, to develop the ejection seat for the F-18 aircraft, reversing the original intention to buy the seats from the Stencel Aero Engineering Corporation of Asheville, North Carolina. Findings/Conclusions: The basis of the award was questionable and it may not have been in the best interest of the government. McDonnell's evaluation of procurement offers found Stencel Corporation's seat to be technically superior, but M-B was selected for the lower price. M-B was granted deviations from specifications in five important areas, and its seat will require a 40% redesign (as opposed to 15% for Stencel). M-B's lower price for development will be more than offset by increased support costs. In the past, M-B has also refused to provide adequate cost data or allow audits. Recommendations: The Navy should reexamine this procurement. Specifically, it should conduct an independent technical evaluation and a comprehensive life cycle cost analysis of the two proposals. Attention should be paid to the waivers given M-B that relate to the aircraft mission and safety of the crew, especially ejection height and stability after ejection. Past difficulties in getting M-B's data should be considered, and also the need for a domestic source for this item. (Author/DJM)

REPORT OF THE COMPTROLLER GENERAL OF THE UNITED STATES

Should The Navy Reverse McDonnell Douglas Corporation's Award Of The F-18 Ejection Seat Contract?

This report discusses the circumstances surrounding the development contractor's award of a contract to develop the ejection seat for the F-18 aircraft. The basis for the award is questionable and it may not be in the best interest of the Department of Defense.

GAO recommends that the Secretary of Defense direct the Secretary of the Navy to reexamine this procurement decision.

PSAD-77-99

APRIL 11, 1977

COMPTROLLER GENERAL OF THE UNITED STATES
WASHINGTON, D.C. 20548

B-183851

The Honorable John J. McFall
House of Representatives

Dear Mr. McFall:

In your October 20, 1976, request to investigate the procurement of ejection seats for the Navy's F-18 aircraft, you specifically asked that we consider the circumstances surrounding the decision of the F-18 prime contractor, McDonnell Douglas Corporation, to award the contract to the Martin-Baker Aircraft Company, Ltd., a British firm. You pointed out that this decision reversed McDonnell's original intention, specified in its proposal to the Navy for the F-18, to buy the seats from the Stencel Aero Engineering Corporation, Inc., of Asheville, North Carolina.

Our review was made primarily at the F-18 Program and Air Crew Escape Systems Offices of the Naval Air Systems Command, Arlington, Virginia. We also visited the offices of McDonnell Aircraft Company, a subsidiary of the McDonnell Douglas Corporation, at St. Louis, Missouri, and Washington, D.C. We examined contract files, reports, and other agency and contractor records as well as procurement policies and procedures. We also discussed pertinent matters with Navy and contractor officials. As you directed, we did not obtain formal advance comments on this report from the Department of Defense or the contractors involved. We did, however, informally discuss the factual matters with Defense personnel and their comments were considered in preparing this report.

The details of our review are included as appendix I to this report. Answers to your questions are included in appendix II. Appendix III is a copy of our June 12, 1975, letter to the Secretary of Defense (B-146905/PSAD-75-94), and the Navy's August 21, 1975, response, relating to previous procurements from Martin-Baker, is appendix IV.

The technical proposal submitted by McDonnell--the basis for its selection to develop the F-18 aircraft--specified an ejection seat developed by Stencel. At a later date, McDonnell decided to obtain competition for the ejection seats.

The Navy agreed to McDonnell's decision on the premise that competition provides greater opportunity for selecting the most capable, reliable product at the least cost and risk. Stencel and Martin-Baker submitted proposals for the full-scale development of an ejection seat and three production options for a total of 119 production seats. Martin-Baker's price was about $3.5 million less than Stencel's. McDonnell's evaluation found the Stencel seat to be technically superior, but Martin-Baker was selected to provide the ejection seats because of the lower price.

The proposals were evaluated against specific engineering and procurement factors. Stencel's proposal was rated considerably higher than Martin-Baker's--790 versus 701 of a possible 1,000 points. The evaluation scoring consisted of a possible 700 points for engineering and 300 points for procurement factors including price: Stencel's proposal received the higher engineering score--588 versus 407 points--while Martin-Baker received the higher procurement score--294 versus 202 points.

Although the McDonnell evaluation showed the Martin-Baker proposal to be inferior to that of Stencel, the engineering evaluation conclusion was that both companies were capable of producing an acceptable ejection seat. Martin-Baker, however, was granted deviations from specifications in five areas which Navy engineering personnel considered important. These deviations included (1) eliminating or reducing safety related requirements (low altitude/adverse attitude capability, certain system redundancy features, and ejection seat stability after ejection), (2) weight restrictions, and (3) using parts not already in the Navy supply system. The Martin-Baker seat will also require an estimated 40-percent redesign of its existing seat to conform with McDonnell specifications; an estimated redesign of 15 percent would be required for the Stencel seat. More qualification testing will be required for the Martin-Baker seat than the Stencel seat. The larger percentage of redesign and qualification testing for Martin-Baker increases the risk of not meeting the delivery date required by McDonnell's production schedule, which could have an adverse impact on the cost of the F-18 program.

The lower price of the Martin-Baker seat may be more than offset by other costs which should have been considered in evaluating the proposals. For example, McDonnell engineers estimated that it would cost $1.3 million more in support costs for the Martin-Baker seat

development than the cost McDonnell would incur for the Stencel seat development. (See p. 18.) Any additional support cost will be borne by the Government under McDonnell's cost-plus-incentive fee contract. The use of the Martin-Baker seat will increase Navy management costs for spare parts inventory. From 200 to 600 more new parts are required for the Martin-Baker than for the Stencel seat because the Stencel seat uses many parts already stocked by the Navy. Introducing a new part into the inventory entails estimated one-time costs of $200 per item and annual recurring estimated costs of $165 per item, excluding the cost of the part itself. Consequently, the Martin-Baker seat will entail one-time costs of between $40,000 and $120,000 and annual costs of between $33,000 and $100,000 over the F-18's 20-year life.

The maintenance costs that would be incurred for the Martin-Baker and the Stencel seats are not known at this time. However, the maintenance costs experienced for a Martin-Baker seat used in the Navy's F-14 aircraft are much higher than the costs for a Stencel seat used in the Harrier aircraft. If the proposed seats for the F-18 require approximately the same level of maintenance as these in-service models, then much higher costs will be incurred for the Martin-Baker seat throughout the service life of the aircraft.

There are indications that Martin-Baker's price does not include full recovery of development costs, which appears to account for a large part of the differences between the two proposals. Based on the approved F-18 program, there will be follow-on contracts for at least 741 seats, as well as spare parts purchases over the life of the aircraft. The review and verification of cost and pricing data will provide the only assurance that future contracts' proposed prices are fair and reasonable and do not include development costs not recovered on the initial contract.

In the past, Martin-Baker has not provided adequate cost data or allowed adequate audits by the Department of Defense or our office, even where the contract included the Comptroller General's access-to-records clause. The Navy has justified the prior use of Martin-Baker ejection seats despite these practices, because they were considered technically superior to seats available from domestic sources. Since the Stencel seat was found to be technically superior by both Navy and McDonnell engineering personnel, quality no longer dictates the use of Martin-Baker seats.

Because of Martin-Baker's failure to provide cost or pricing data and to allow us unrestricted access to their books and records, we recommended, in June 1975, that the Secretary of Defense consider other procurement strategies for future needs. In commenting on this report, the Secretary advised us that the F-18 would be equipped with a Stencel ejection seat.

CONCLUSIONS

Based on our review of available information, we believe that the selection of Martin-Baker to develop the F-18 ejection seat was not in the best interests of the Department of Defense or the F-18 program. In formulating this opinion, we especially considered the Navy's interest in commonality, reliability, and maintainability which have been stressed throughout the F-18 procurement cycle.

The Navy has directed the procurement of the Martin-Baker seats for many of its aircraft in prior years because they were considered technically superior to those manufactured domestically. Now that a technically superior seat is available domestically, Navy's continued reliance on the Martin-Baker seat is questionable.

Furthermore, the price advantage, upon which the award was made to Martin-Baker, relates primarily to the offered price for developing the ejection seat. It is not based on a serious consideration of the total cost of developing, buying, operating, and maintaining the system.

RECOMMENDATIONS

We recommend that the Secretary of Defense direct the Navy to reexamine this procurement decision. Specifically, the Navy should conduct an independent technical evaluation and a comprehensive life cycle cost analysis of the two ejection seat proposals. The technical evaluation should give particular attention to the effect of the waivers granted Martin-Baker on the mission of the aircraft and the safety of the crew, especially those related to ejection height and stability after ejection. The Navy should also consider past difficulties in obtaining cost or pricing data from Martin-Baker in support of proposed prices and the need to maintain a domestic source for this critical component.

If warranted, the Secretary of the Navy should direct McDonnell Douglas to terminate the Martin-Baker contract and award the F-18 ejection seat development contract to Stencel. (McDonnell's liability to Martin-Baker for termination is limited by the contract to $75,363.32 through May 1977, and $126,326.32 through September 1977.) If the contract is to remain with Martin-Baker, written agreements should be obtained from them and the British Government that we and the Defense Department be allowed unrestricted access to Martin-Baker's books and records relating to this and future procurements of F-18 ejection seats, including direct audits and evaluation by Defense and our personnel of costs incurred, engineering and management cost estimates, and overhead and rate structures.

As agreed, we are sending copies of this report to the Chairmen of the Senate Committee on Governmental Affairs; House Committees on Government Operations, Appropriations, and Armed Services; the Secretary of Defense; the Secretary of the Navy; and the Director, Office of Management and Budget.

Sincerely yours,

ACTING Comptroller General
of the United States

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ABBREVIATIONS

DMMH/FH	direct maintenance man-hours per flight hour
DOD	Department of Defense
FDS	full-scale development
NAVAIR	Naval Air Systems Command
RFP	requests for proposals

APPENDIX I

PROCUREMENT OF EJECTION SEATS FOR F-18 AIRCRAFT

BACKGROUND

The McDonnell Aircraft Company (McDonnell), a subsidiary of the McDonnell Douglas Corporation (McDonnell Douglas), was selected on May 2, 1975, to develop the Navy Air Combat Fighter (designated the F-18) as a result of its technical proposal based on the YF-17 prototype aircraft. McDonnell's technical proposal specified the SIIIS-3F17 ejection seat developed by the Stencel Aero Engineering Company (Stencel).

The Navy, based on McDonnell's accepted technical proposal, expected the F-18 aircraft to include the Stencel ejection seat as contractor-furnished equipment. The proposed Stencel seat would be a derivative of the seat developed by Stencel for the U.S. Marine Corps' AV-8A Harrier aircraft under contract with the Naval Air Systems Command (NAVAIR), to replace the Martin-Baker 9AMK1 seat originally used in the Harrier. The Stencel seat was developed because major deficiencies were identified with the Martin-Baker seat. For this reason, much of the qualification testing conducted for the Harrier seat would be applicable for Stencel's proposed F-18 ejection seat.

In October 1975 McDonnell informally advised NAVAIR that a competitive procurement was being considered for the F-18 ejection seat. The competitive candidate being considered was Douglas Aircraft Company (Douglas), another subsidiary of McDonnell Douglas. In addition, on March 3, 1976, the Martin-Baker Aircraft Company, Ltd., (Martin-Baker) requested that it be allowed to submit a proposal for the seat. On March 24, 1976, the president of McDonnell Douglas approved competition for the F-18 ejection seat development contract.

NAVAIR was formally notified of this decision on March 29, 1976. An April 6, 1976, internal NAVAIR document stated that any choice other than the Stencel seat was unacceptable to the Navy because of adverse impacts on the F-18 program, namely increased technical risk, increased cost, and increased schedule. This document recommended that McDonnell either retract its March 29 notification, or demonstrate that an ejection seat competition would be in the best interests of the Navy.

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McDonnell briefed NAVAIR on its reasons for advocating a competitive procurement and cited the following reasons:

--There is no existing ejection seat that fits the F-18 cockpit without extensive modifications.

--There are three companies--Stencel, Martin-Baker, and Douglas--capable of building a seat that will meet F-18 requirements.

--Competition allows the selection of the most capable, reliable seat at the least cost and risk.

--A Memorandum of Understanding between the United States and United Kingdom requires consideration of United Kingdom firms where qualified.

--Sole source to Stencel, which is in the process of being acquired by Talley Industries, presents a potential risk to the F-18 program.

--McDonnell Douglas wants to compete for the F-18 ejection seat development contract.

On May 5, 1976, NAVAIR agreed to McDonnell's decision to open the ejection seat development to competition on the general premise that competition provides greater opportunity for selecting the most capable, reliable product at the least cost and risk.

SELECTION OF MARTIN-BAKER

Introduction

On June 2, 1976, requests for proposals (RFP) were sent to Stencel, Douglas, and Martin-Baker with a response deadline of July 19, 1976. Stencel and Martin-Baker submitted timely proposals for the ejection seat. Douglas, however, notified McDonnell on July 21, 1976, that it was withdrawing from the competition because of (1) the high initial development costs for the seat, (2) the fact that the Navy participated in developing the Stencel seat, and (3) the more advanced development state of the Stencel and Martin-Baker seats.

The proposals were subjected to McDonnell's prescribed procurement and technical evaluations. Negotiations were then held with the offerors to resolve discrepancies on technical factors between RFP and their proposals. After

the negotiations, the offerors were given the opportunity to submit revised price proposals. Shortly after receiving the price revisions, McDonnell selected Martin-Baker.

Overall evaluation

An overall evaluation score is obtainable by combining the results of the independent engineering and procurement evaluations for a total score based on a 1,000 point maximum. Of these 1,000 points, 700 were assigned to the engineering evaluation and 300 to the procurement evaluation for the ejection seat selection. The results of the overall evaluation scoring are as shown below.

	Maximum points	Martin-Baker	Stencel
Engineering	700	407	588
Procurement	300	294	202
Total	1,000	701	790

As indicated by the point scores above, both the technical and the overall evaluation favored the Stencel proposal, while the procurement evaluation favored Martin-Baker.

Engineering evaluation

McDonnell's engineering department evaluated the proposals on the basis of

--compliance with technical requirements,

--status of development, and

--capability and schedule.

The engineering evaluation assesses the degree to which proposals comply with the various technical criteria in each of the three categories. These assessments are represented by a numerical scoring system.

Martin-Baker's proposal received 58 percent of the maximum point score (407 out of a possible 700 points), while Stencel's proposal received 84 percent (588 of 700 points). According to McDonnell's guidelines, proposals falling into the 0- to 59-percent range indicate that "the proposed method fails to meet the stated requirements or falls short of ideal characteristics in a manner that degrades performance or

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significantly increases risk." The 60- to 89-percent range indicates that "the proposed method falls short of ideal characteristics but is still acceptable." (Emphasis added.)

McDonnell's report on the engineering evaluation results indicates that the Martin-Baker proposal was scored higher than the proposal alone deserved. This was done by the evaluators because, based on prior experience with Martin-Baker, it was assumed that Martin-Baker would agree to change its proposal to conform to McDonnell's requirements.

General comments included in the summary of the engineering evaluation indicated the following:

--The Martin-Baker proposal has major compliance deficiencies because of its large overweight design, susceptability to corrosion, and failure to use standard parts from the Navy's inventory. The complex mechanical design requires over-specialized maintenance with reduced reliability. McDonnell engineers judged this as an inadequate response to the compliance with the technical requirements category. They also noted that major qualification testing would be required to validate the Martin-Baker seat.

--Redesign of the Martin-Baker MK-10 seat is estimated at 40 percent to conform with McDonnell's ejection seat procurement specifications. Martin-Baker was considered to have excellent capabilities and facilities for hardware production, but was considered deficient in data management and schedule compliance.

--Stencel's response to the compliance with the technical requirements category was considered excellent and required little final negotiations. McDonnell engineers estimated that medium requalification would be required in areas of change from the inservice AV-8A Harrier aircraft ejection seat. Redesign changes to Stencel's Harrier seat were estimated at approximately 15 percent. Stencel facilities for production were considered to be limited but adequate. Stencel's seat incorporrates major hardware utilized on existing qualified seats; thus Stencel's ability to meet schedules is low risk. Stencel is also familiar with current integrated logistical support (ILS) requirements and data submittal procedures.

Although the engineering evaluation showed that the Martin-Baker proposal was inferior to Stencel's, the conclusion was that both Stencel and Martin-Baker were capable of producing an acceptable ejection seat.

Procurement evaluation

McDonnell's procurement evaluation, which also uses a scoring system, is based on the five factors shown below with price being, by far, the most important. The following table summarizes the results of the procurement evaluation:

Factor	Maximum points (note a)	Martin-Baker points awarded (note a)	Stencel points awarded (note a)
Management and experience	4.5	4.50	2.85
Program plan	6.0	5.85	5.49
Quality control	30.0	27.30	27.90
Price review	210.0	210.00	120.00
Contractual agreements	49.5	46.80	45.30
Total	300.0	294.45	201.54

a/Maximum points and points awarded reflect the 30-percent weight assigned to procurement factors.

As indicated above, the major difference between the proposals in the procurement evaluation scoring is the price review which represents 70 percent of the procurement evaluation.

The prices proposed and evaluated in the price review were:

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	Martin-Baker	Stencel
Full-scale development (FSD) (38 seats)	$1,899,978.11	$4,532,920.66
Option I (9 seats)	344,649.13	502,387.13
Option II (34 seats)	1,251,450.58	1,479,994.26
Option III (76 seats)	3,111,817.18	3,345,264.80
Total (157 seats)	$6,607,895.00	$9,860,566.85

McDonnell representatives stated the lowest price offer automatically receives the maximum allowable points for the price review. Consequently, because of its $3,252,671.85 price advantage, the Martin-Baker proposal was scored considerably higher.

Negotiations

McDonnell concluded that neither proposal met all the specifications contained in RFP but that with modifications both proposals would be acceptable. McDonnell then met separately with each offeror to resolve the deviations of their respective proposals from the RFP specifications. Negotiations to reach agreements on the resolution of these deviations were held with Stencel from August 18 to 20, 1976, and with Martin-Baker from August 23 to 25, 1976. Upon completion of the negotiations, each offeror was given the opportunity to submit revised price proposals. The price revisions were due by September 3, 1976, for Stencel and September 10, 1976, for Martin-Baker.

The negotiations resulted in agreements between McDonnell and the offeror wherein either McDonnell agreed to changes in the specifications or the offeror agreed to make specific changes in its proposed development so that deviations between the proposal and the specifications were resolved. Most of the deviations granted to Stencel and Martin-Baker were either similar or considered minor. Generally, the deviations from the specifications were granted because the offeror's product was either superior to RFP specifications or a different process proposed by the offeror made the specifications inapplicable.

Martin-Baker, however, was granted deviations from the specifications in five areas which NAVAIR engineering personnel considered to be important because the product to be supplied will not meet the original specifications. In contrast, however, Stencel would have substantially met the original specifications. The deviations granted to Martin-Baker concerned the following:

--The Martin-Baker ejection seat could not fully meet the specifications concerning redundance (i.e., certain critical components were required to have a backup system should the main system fail), and McDonnell agreed to eliminate some of the redundancy requirements.

--The minimum altitude requirement for successful adverse position (e.g., upside down) ejections was made less stringent because the Martin-Baker ejection seat could not meet the requirement. This was a major reason why the Martin-Baker seat was dropped from consideration by the Air Force for the F-16 aircraft.

--A deviation was granted to Martin-Baker on the requirement for a parts standardization program. Therefore, instead of using standard parts already in the Navy supply system, Martin-Baker would be allowed to substitute other parts.

--The Martin-Baker seat could not meet the requirement that the seat's angle during an ejection could not deviate more than 20 degrees in any direction from the upright position and thus, this requirement was waived.

--The weight requirement of 164 pounds was waived because it could not be met by the Martin-Baker seat which will weigh 196 pounds. Regarding this weight, Stencel's proposed seat would have weighed 165 pounds.

Martin-Baker did not revise its price proposal of $6,607,895 after the negotiations. Stencel, however, increased its price by $291,818 to $10,152,385. The price difference between Martin-Baker's and Stencel's proposals was $3,544,490. The following table shows these differences in detail.

ANALYSIS OF INITIAL COST PROPOSALS

	Total cost			Average unit cost (note a)		
	Martin-Baker	Stencel	Difference	Martin-Baker	Stencel	Difference
FULL SCALE DEVELOPMENT						
38 ejection seats	$1,040,439	$1,459,688	$ 419,249	$27,380	$38,413	$11,032
Other charges	859,539	3,073,233	2,213,694			
Total	1,899,978	4,532,921	2,632,943			
PRODUCTION OPTION #1						
9 ejection seats	293,662	353,264	59,602	$32,629	$39,252	$ 6,625
Other charges	50,987	149,123	98,136			
Total	344,649	502,387	157,738			
PRODUCTION OPTION #2						
34 ejection seats	1,223,663	1,403,295	179,632	$35,990	$41,273	$ 5,282
Other charges	27,788	76,699	48,911			
Total	1,251,451	1,479,994	228,543			
PRODUCTION OPTION #3						
76 ejection seats	3,089,634	3,169,641	80,007	$40,653	$41,706	$ 1,053
Other charges	22,183	175,624	153,441			
Total	3,111,817	3,345,265	233,448			
Total full-scale development and options 1 through 3	$6,607,895	b/$9,860,567	$3,252,672			

a/Average unit costs are based on offered prices for ejection seats excluding other nonhardware cost charges such as data and reporting requirements.

b/After the technical negotiations, Stencel increased its offered price by $291,818 to $10,152,385, thereby increasing the difference between the proposals to $3,544,490 ($2,924,811 for development, and $619,679 for the production options.)

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The potential Navy savings will be $3,021,495 consisting of $2,339,848 on the FSD contract and $681,647 on production options I, II, and III, if exercised, as calculated below:

--The FSD prime contract with McDonnell is a cost-plus-incentive-fee-type contract with an 80/20-share ratio. In effect, the Government's share is 80 percent of any cost overrun or underrun. Therefore, the savings to the Government would be 80 percent of the $2,924,811 difference, or $2,339,848.

--The $619,679 difference on production options I, II, and III will be saved as well as an estimated $61,968, representing the savings of fee/profit to McDonnell on the options. This is possible because the Navy had not yet negotiated prices with McDonnell for production lots I, II, and III. ($619,679 + $61,968 = $681,647.)

These savings, however, could be more than offset by the costs discussed on page 15.

As shown in the cost proposal comparison on page 8, most of the difference relates to the development portion of the proposals. The differences in the unit prices of the proposed ejection seats narrow with each successive production option.

McDonnell officials briefed representatives of NAVAIR on October 13, 1976, concerning their intention to select Martin-Baker as the developer of the F-18 ejection seat. NAVAIR had the authority to disapprove McDonnell's selection. By not doing so, they tacitly approved the selection of Martin-Baker.

On October 14, 1976, Stencel's president visited the McDonnell buyer for the F-18 ejection seat and informed him that Stencel wanted to reduce its offer for the ejection seat by several million dollars and expected to submit a revised offer later that day. The buyer advised the president that McDonnell management would not consider a revised offer. The president then said she would still submit a revised offer by teletype. The buyer informed her that the contract award could be made by October 19, 1976. Shortly after advising McDonnell management of Stencel's intent to submit a revised offer, the McDonnell buyer was directed to announce the award. At approximately 4 p.m. (CDT), on October 14, 1976, McDonnell notified Martin-Baker of its selection. On October 15, 1976,

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Stencel submitted a revised price offer for the full-scale development and three production options which totaled $5,700,000, or about $900,000 less than Martin-Baker's price.

Factors cited for selection of Martin-Baker

The lower price for what was considered an acceptable ejection seat was the prime reason cited by McDonnell for selecting the Martin-Baker proposal over that of Stencel. The recommendation to select Martin-Baker, made by McDonnell's Procurement Review Board to McDonnell's top management, acknowledged the technical superiority of the Stencel seat. This was done at the insistence of the McDonnell engineers, who strongly favored the Stencel seat.

tencel inqui y and Navy actions

On October 23, 1976, Stencel sent a protest letter to McDonnell Douglas protesting the F-18 ejection seat award to Martin-Baker. A copy of this protest was also delivered to the Under Secretary of the Navy. Stencel's protest was based on the following:

--Stencel has had an unqualified right to the contract for the supply of F-18 ejection seats.

--Stencel's revised offer was at a lower price than that contained in the contract awarded to Martin-Baker.

--The Martin-Baker proposed ejection seat does not conform to the F-18 ejection seat specifications.

--For purposes of Federal procurement decisions, McDonnell Douglas must and should have disqualified itself from ejection seat source selection.

On October 26, 1976, the Under Secretary of the Navy directed NAVAIR to review the technical advisability of selecting the Martin-Baker seat and the method of awarding the subcontract for ejection seats. The NAVAIR review was conducted from October 28 to 30, 1976, at the McDonnell facility in St. Louis, Missouri, and November 1 to 3, 1976, at NAVAIR Headquarters, Washington, D.C.

The NAVAIR team reviewed (1) procurement guidelines as defined in McDonnell management directives, (2) engineering guidelines for the technical proposal evaluation contained in McDonnell Engineering Operating Procedures, and

(3) the actual procedures followed, the evaluations performed, and the selection made by McDonnell during the ejection seat competition. The review team did not conduct an independent source selection.

The Navy review team concluded:

--Considering both technical performance and price, the Martin-Baker seat as described in the purchase order is as desirable for use in connection with the F-18 as the Stencel seat.

--The award to Martin-Baker was in compliance with McDonnell's and McDonnell Douglas' approved purchase order systems.

At the request of the Under Secretary, NAVAIR also provided information on (1) a quantitative evaluation of the ejection seat technical proposals as modified by negotiated agreements, (2) an estimated cost of a dual source development program for the ejection seat, and (3) the potential legal and financial impact of the termination of the Martin-Baker subcontract. NAVAIR also provided the Under Secretary information on the possibility that foreign firms get favorable treatment when competing with U.S. firms for defense programs.

Our observations on Navy reaction to the selection of Martin-Baker

During our investigation we interviewed NAVAIR officials representing both procurement and engineering functions for the F-18 ejection seat. These discussions gave us the impressions that NAVAIR engineers

--were convinced the Stencel ejection seat would be selected for the F-18,

--believed the Stencel seat was technically superior to the Martin-Baker seat, and

--were very surprised that Martin-Baker was selected instead of Stencel.

The only official Navy position on the selection of Martin-Baker was the NAVAIR review of McDonnell's source selection for the ejection seat conducted for the Under Secretary of the Navy. This review concluded that the procurement had been conducted in accordance with McDonnell's

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approved purchase order system and that both the Stencel and Martin-Baker seats were desirable for use in the F-18.

FACTORS FAVORING STENCEL

McDonnell has stated that Martin-Baker was selected to develop the ejection seat for the F-18 aircraft primarily because of the price advantage that Martin-Baker offered. Aside from the price advantage, many factors pertinent to the ejection seat development favored the selection of Stencel. Also, the apparent price advantage of the Martin-Baker selection is subject to qualification, as discussed on pages 15 through 19.

Technical superiority

Both Navy and McDonnell engineers have judged the Stencel seat to be technically superior to the Martin-Baker seat. The technical advantages of the Stencel seat include the following:

--The proposed Stencel seat employs fewer mechanical processes than the Martin-Baker seat and, therefore, has far less moving parts, thus resulting in higher reliability and lower possibility of failure due to mechanical fatigue or maintenance errors.

--Stencel's proposal calls for the use of processes and materials that are more resistant to fatigue and action by the elements and thus considered by the Navy to be superior to those proposed by Martin-Baker.

--The proposed Stencel seat will meet or exceed all major specifications for the ejection seat set out in the RFP. Martin-Baker, however, will not meet all of these major specifications and requires that certain of them be either reduced or waived. (See p. 7.)

--The proposed Stencel seat would weigh approximately 31 pounds less than the Martin-Baker seat (165 versus 196 pounds). We were informed that this lower weight, like the fewer number of movable parts, are in large part due to Stencel's use of more expensive light-weight metals.

--The use of light-weight metals and fewer moving parts has allowed Stencel to build in more redundance, as

required by the specification, than can be incorporated into the Martin-Baker seat. The redundancy is desired because it minimizes the possibility that a single component or subsystem failure will preclude a successful ejection.

--The Stencel seat is considerably faster in achieving stability after ejection. In certain positions--notably adverse attitude--the Martin-Baker seat requires over double the terrain clearance of the Stencel seat for a successful ejection. In addition, the Stencel seat, unlike the Martin-Baker seat, stabilizes oscillation of the seat within 20 degrees of vertical. In the opinion of Navy medical personnel, oscillation in excess of 20 degrees significantly increases the chance of pilot injury.

Greater risk in Martin-Baker development

The proposed Martin-Baker seat will require a 40-percent design change to the existing Martin-Baker MK-10 seat in order to meet F-18 ejection seat specifications. The Martin-Baker MK-10 seat has not been qualified by any U.S. defense or technical authorities. Thus, it will require major qualification testing. This is in contrast to the Stencel seat which will require only 15 percent or less in redesign of the Stencel seat which was qualified for and used in the Harrier aircraft. Consequently, the Stencel seat will require only medium requalification. Regarding the qualification testing and evaluation, Martin-Baker has agreed to pay the Navy for these costs estimated by the Navy to be about $500,000.

Martin-Baker has indicated the lead time required for the first preproduction unit is 18 months compared to 12 months for Stencel. Counting from November 1976, 18 months would run through April 1978. McDonnell requires delivery of the first seat by May 1978 in preparation for first flight of the F-18 aircraft in July 1978. NAVAIR engineers indicated first flight could be conducted without the Martin-Baker seat (using any other seat available), but it would be restricted in altitude, speed, bank angle, and related performance factors.

NAVAIR engineers we talked with have expressed some doubt that Martin-Baker can satisfy the ejection seat requirements it agreed to and still meet the F-18 aircraft development schedule. Any delays in delivery of the ejection seat could have an adverse impact on the F-18

program schedule and thus, F-18 program costs. During the July 1978 time frame, F-18 program expenditures will be approximately $30 million a month.

Prior difficulties in contracting with Martin-Baker

In its prior contracts with the Department of Defense (DOD), Martin-Baker has consistently refused to comply with certain contractual requirements required of all contractors doing business with DOD. (See apps. III and IV.) Specifically, Martin-Baker has refused to

--submit certified cost or pricing data in support of its proposed prices for noncompetitive contracts and

--accept the cost accounting standards clause in its contracts.

In the past, waivers of these requirements have been granted because of the urgency of the procurements. In addition, Martin-Baker's longstanding position has been that neither we nor any other U.S. Government agency will be permitted to review its books and records. This position, relative to us has been taken even when the contract included the Comptroller General's access-to-records clause.

The unanswered question is what position Martin-Baker will take with regard to these contractual requirements on the full-scale production and future spare parts contracts which will most likely be sole source procurements.

The Navy has traditionally made these types of procurements on a sole source basis because

--engineering data and rights could not be obtained from Martin-Baker; therefore, the Navy lacked information which would allow it to competitively procure these items and

--reverse engineering of either the ejection seat or spare parts would be very difficult and expensive.

McDonnell's contract with Martin-Baker only covers (1) the development of the seat, (2) the delivery of 38 developmental units, and (3) production options for 119 seats. Since the Navy anticipates buying a minimum of 860 production seats, at least 741 seats will probably be purchased under a sole source contract with Martin-Baker.

As noted on page 13, Martin-Baker will incur an estimated $500,000 over and above the development cost for major qualification testing. Also, according to a McDonnell official, Martin-Baker's price proposal does not include all of the cost that will be incurred to develop a competitive product for the U.S. ejection seat market. Unless Martin-Baker agrees in the follow-on production and spare parts contracts to (1) submit certified cost and pricing data, (2) adhere to the cost accounting standards, and (3) allow the audit of its records, DOD can not assure itself that Martin-Baker is not including unrecovered development costs under its production and spare part contracts and, thus, negating the price advantage in its price for the development contract. The Navy will also not be able to determine if Martin-Baker's proposed prices are fair and reasonable.

Life cycle costs not adequately considered in selecting Martin-Baker

The Navy, as a result of McDonnell selecting Martin-Baker, may incur additional costs which could result in the Martin-Baker seat becoming more expensive than the Stencel seat over the operational life of the F-18 aircraft. Throughout the F-18 development program, NAVAIR has put considerable emphasis on life cycle costs, reliability, and maintainability. Life cycle cost was one of the factors to be considered by McDonnell in its evaluation process.

The use of life cycle costing as a procurement technique recognizes the need to consider all significant costs associated with the decision to procure one firm's product over another. Life cycle costs include the costs to develop, produce, operate, support, and maintain the equipment over its full life cycle.

During the evaluation of the ejection seat proposals, McDonnell performed some limited analysis of life cycle costs, but considered the results to be inconclusive. Consequently, life cycle costs were not seriously considered in selecting the development contractor.

Navy life cycle cost engineers believe McDonnell has the capability of doing extremely sophisticated life cycle cost analysis. They also believe that McDonnell's life cycle cost analysis of the ejection seat proposals was extremely primitive considering its background and available expertise.

We have discussed life cycle costing with Navy ejection seat experts. They stated that Stencel's life cycle costs will be lower than Martin-Baker's and could more than offset Martin-Baker's development price advantage. The factors they cited against Martin-Baker included (1) increased inventory costs, (2) higher maintenance costs (both operational and rework), and (3) lower reliability.

Because of the emphasis placed on cost during the ejection seat contractor selection, we think that an indepth analysis of the proposal price differences was warranted. Regarding this, we believe that the total cost of developing, procuring, supporting, and maintaining the planned 860 ejection seats should have been compared over the estimated life of this system. The results of such an analysis should be a major consideration for a procurement decision which is based essentially on price differences of competing systems. We found no evidence to indicate that this was the case in this procurement decision. Examples of the costs which we believe did not receive adequate consideration are

--the nonrecurring costs of adding 200 to 600 additional spare parts to the Navy inventory system and subsequent costs in managing this inventory and

--additional maintenance costs for the Martin-Baker seat.

The following discussion of these costs indicates why the initial price advantage is not a proper basis for selecting the development contractor.

Spare parts costs

NAVAIR engineers estimate that the Martin-Baker seat will add to the Navy's parts inventory a minimum of about 200 spare part items more than would the Stencel seat. Depending on the final Martin-Baker seat design, this difference could be as much as 600 spare part items.

Our 1975 study estimates that

--the nonrecurring cost of adding a new item to the inventory is about $200 1/ per item and

--the annual costs of maintaining a part in the inventory is approximately $165 1/ annually.

1/1975 dollars.

Thus, the selection of Martin-Baker will result in additional nonrecurring spare parts costs of between $40,000 and $120,000 and annual recurring costs of between $33,000 and $99,000 over the probable 20-year life of the F-18. These costs exclude the actual cost of the inventory items.

Maintenance costs

Martin-Baker's ejection seat as proposed would require 0.07 direct maintenance man-hours per flight hour (DMMH/FH); however, during negotiations with McDonnell, Martin-Baker agreed to meet Navy specification of 0.05 DMMH/FH. In actual fleet service, the Martin-Baker seat in the F-14 aircraft has required 0.15 DMMH/FH.

Stencel's proposal stated that its seat would require 0.004 DMMH/FH (12.5 times better than the requirement of 0.05 DMMH/FH). In actual service, the Stencel seat in the Marine Corps Harrier aircraft has required 0.05 DMMF/FH.

Both the proposals submitted and actual in-service experience reflect significant differences in maintenance requirements and thus, maintenance costs. NAVAIR engineers consider the Stencel proposal of 0.004 DMMH/FH unachieveable since it represents essentially a maintenance-free seat. Consequently, we did not compare the Stencel proposed DMMH/FH with that proposed by Martin-Baker. Instead, we calculated the maintenance differences over the system's life based on the actual maintenance being experienced.

Indications of possible maintenance cost differences are presented below based on a 20-year service life, an average hourly labor cost of $16.08, and in-service seat maintenance experienced in the F-14 and Harrier aircraft.

	Flight hours per aircraft (note a)	X	DMMH/FH	X	Average labor hour cost	X	F-18 seat requirements	Total maintenance costs
								(millions)
Martin-Baker	6,000		0.15		$16.08		871	$12.6
Stencel	6,000		.05		$16.08		871	4.2
Potential saving with Stencel seat								$ 8.4

a/Based on a 20-year service life.

If the proposed ejection seats for the F-18 aircraft require the same level of maintenance as their respective inservice seats, then there is a significant cost advantage with the Stencel seat.

Management costs

McDonnell engineers estimated during the proposal evaluation process that McDonnell would have to incur an additional $1.3 million in support costs to develop the Martin-Baker seat over what it would have to incur to develop the Stencel seat. These costs were estimated to cover McDonnell's need to provide (1) assistance in meeting integrated logistical support and reliability and maintainability requirements, (2) assistance in recordkeeping, and (3) travel for McDonnell engineers.

McDonnell procurement officials disagreed with the estimate, but would not offer an alternative figure. In contrast NAVAIR engineers expressed the opinion that the $1.3-million estimate is not unrealistic. As an example, when NAVAIR engineers questioned McDonnell representatives concerning how Martin-Baker would meet certain requirements agreed to during the negotiations, they responded that McDonnell would furnish management support to Martin-Baker in these areas.

This cost will be borne by the Government under the cost-incentive fee contract with McDonnell and could substantially reduce the potential savings discussed on page 9.

Rights in data

Another factor which, in our opinion, favors the selection of Stencel concerns the Navy's ability to obtain rights in technical data. Rights in data are of two types--limited and unlimited.

Limited rights are defined in ASPR 9-201(b) as:

"Rights to use, duplicate, or disclose technical data in whole or in part, by or for the Government, with the express limitation that such technical data shall not, without the written permission of the party furnishing such technical data be (1) released or disclosed * * * outside the Government, (2) used * * * by the Government for manufacture, or (3) used by a party other than the Government, except for: emergency repair * * * or * * * release to a foreign government."

APPENDIX I

Unlimited rights allow the obtainer the right to have the data freely available for any purpose, including competitive procurement. Whoever has paid the development cost has the dominant interest in the rights to the technical data pertaining to that product.

If Stencel had been selected, the Navy would have had essentially unlimited rights in the data concerning the Stencel ejection seat because

--the Navy paid for the development of the basic Stencel seat (approximately $11 million) and

--the Navy would be paying for the modifications to that seat under this contract and would also have rights to this data.

With Martin-Baker, however, the Navy would not obtain unlimited rights because

--Martin-Baker, not the Navy, paid for the development of the basic ejection seat and

--Martin-Baker may be paying a portion of the costs for the modifications to the basic seat.

Consequently, the Navy, by accepting the lower priced Martin-Baker proposal, has in all probability given up unlimited rights in the technical data for the F-18 ejection seat.

QUESTIONS AND ANSWERS

Provide us with your comments on the attached narrative and legal conclusions you derive therefrom.

See appendix I and answers to the following questions.

Was the price bid by Martin-Baker a "DUMPING" as defined by the ANTI-DUMPING ACT?

Dumping, as defined by the Anti-Dumping Act (19 U.S.C. 160-171), refers to the sale of foreign products in the United States at less than their foreign market value. The law provides that when petitioned to do so, the Secretary of the Treasury direct the Commissioner of Customs to conduct an investigation. After receiving the Commissioner's recommendation, the Secretary rules on the merits of the petition.

The contract between McDonnell and Martin-Baker is for the development of an ejection seat not previously marketed. As a result, there is no established foreign market value. However, it appears that the price offered by Martin-Baker will not allow recovery of all the costs they will incur in performing under the contract.

As of March 1, 1977, the Secretary has not been requested to rule on the Martin-Baker ejection seat.

Is McDonnell Douglas in an apparent conflict of interest position so that the integrity of the Federal Procurement System requires both the Navy and McDonnell Douglas to disqualify McDonnell Douglas as a source selector of ejection seats?

The following factors could be perceived as giving the appearance of a conflict of interest situation:

--Douglas Aircraft Company is a subsidiary of the McDonnell Douglas Corporation, and is a major competitor to Stencel in the domestic ejection seat market. The impact on Stencel from not receiving the F-18 ejection seat contract could indirectly benefit Douglas Aircraft.

--McDonnell Douglas Corporation through its subsidiary, McDonnell Douglas Astronautics East (MDAE), has contracts with the United Kingdom to design a British version of the Navy's Harpoon missile, both submarine and air launch versions. In addition, a speculative

APPENDIX II

high-risk program is being negotiated between MDAE and the United Kingdom to develop a replacement for a missile used by the British Royal Air Force. A Navy official indicated that British acceptance of the program to replace the missile has been greatly dependent on McDonnell Douglas marketing efforts. The cost of these programs run into the hundreds of millions of dollars.

--McDonnell Douglas is also discussing with European countries, including the United Kingdom, development of medium and short range civil aircraft.

We have not, however, found any evidence to indicate that any of these factors influenced McDonnell's selection of Martin-Baker.

What representation and inducements were made by the British Government and Martin-Baker, or any of its affiliates, to McDonnell Douglas and the Navy to induce the selection of the Martin-Baker ejection seat?

Were these inducements and representations material enough to color the selection process' objectivity?

We found no evidence that any inducements were made to McDonnell Douglas or the Navy by either the British Government or Martin-Baker or any of its affiliates concerning the selection of the Martin-Baker ejection seat.

Does the Martin-Baker ejection seat proposed to McDonnell Douglas fully meet the Navy's specifications for the F-18 as awarded?

If not, in what areas is the Martin-Baker ejection seat deficient as compared to those specifications?

The ejection seat proposed by Martin-Baker to McDonnell did not meet the Navy's specifications. The details concerning the deficiencies are discussed in appendix I, on page 7.

Has the Martin-Baker ejection seat for the F-18 been evaluated for conformance to the Navy's specifications?

The Martin-Baker ejection seat was evaluated by McDonnell Douglas for conformance to the Navy's specifications. (See app. I, pp. 3 through 5.)

Was the evaluation of the Martin-Baker ejection seat, if performed, based on data from tests done under U.S. Navy auspices and supervision or is the Navy accepting uncorroborated Martin-Baker data?

The Martin-Baker proposal involves the development of a new ejection seat which has never been tested by the U.S. Government. This development entails a major redesign (approximately 40 percent) of an existing Martin-Baker seat which also has never been tested domestically. Once developed, the seat will undergo testing by the Navy, estimated to cost about $.5 million, which Martin-Baker has agreed to pay.

Did the Navy, in its presentation and testimony to the Congress in connection with justifying the authorization and appropriation for the F-18 aircraft, provide information or rely on data showing that the McDonnell Douglas proposal for the F-18 containing the Stencel ejection seat form the basis of the authorization or appropriation request?

We reviewed the Navy's congressional testimony regarding authorizations and appropriations for the F-18 aircraft program and did not find any testimony specifically stating that the Stencel ejection seat would be used in the F-18. The Navy did testify that the F-18 aircraft would be developed in accordance with the McDonnell Douglas' technical proposal specifying use of the Stencel seat.

Are there any legal or procurement questions or irregularities which would require ordering McDonnell Douglas to cancel its award or require your office to issue an opinion that it will not approve the accounts of the Navy for all or any part of the F-18 aircraft funds expended for a Martin-Baker ejection seat?

Although we find no violation of procurement statutes or regulations which would require ordering McDonnell Douglas to cancel its award to Martin-Baker, the findings in appendix I of this report warrant the Navy's reexamination of the award of the subcontract to Martin-Baker. However, in the absence of a finding of a violation of statutes or regulations, our Office would have no basis for taking exception to any funds expended for the Martin-Baker seat.

Considering the F-18 aircraft only, how many jobs in the U.S. over how many years are encompassed by the ejection seat? Please reply both as to jobs by the seat supplier and as to that supplier's subcontractors and other vendors.

In December 1977 Stencel will be producing ejection seats for the Federal Republic of Germany's Alpha Jet at the rate of 25 seats per month. The Alpha Jet contract will be completed about March 1979. At this time Stencel has no firm prospects for further ejection seat orders.

A Stencel official advised us that as a result of its losing the F-18 contract, 85 employees have been released and 20 more will be released. Stencel informed us that, had they been awarded the F-18 contract, it would have been necessary to immediately hire an additional 20 employees, namely engineers. This same official informed us that he believed there would be an impact on employment at Stencel subcontractors; however, specific information concerning this impact was not available.

What is the net effect on the U.S. balance of payments and tax revenue on an off-shore procurement of ejection seats for the F-18 aircraft?

The potential effect on the U.S. balance of payments on an offshore procurement of 860 ejection seats for the planned buy of 800 F-18 production aircraft would be approximately $37 million, computed as follows:

	Price (note a)	Production quantity
Development	$ 1,899,978	-
Production Options I	344,649	9
II	1,251,451	34
III	3,111,817	76
Remaining production (note b)	30,340,245	741
Total	$36,948,140	860

a/1976 dollars.

b/Based on Martin-Baker quoted unit price for Option III. ($3,111,817÷76 = $40,945.)

Any estimate of this procurement's effect on tax revenues would be very speculative because of the many unknown variables, such as the corporate profit level on the specific procurement as well as the corporation's overall profit/loss situation for those years the contract is in force.

Is the British Government providing any direct or indirect subsidy to Martin-Baker in connection with performance of an F-18 escape seat contract, including but not limited to, ey, tax preference, furnishing facilities, and furnishing o. test and evaluation services and facilities?

We found no indications that the British Government was providing any direct or indirect subsidy to Martin-Baker aside from the waiver of some indirect costs and overhead charges related to the use of certain British Government test and evaluation facilities being used by Martin-Baker. Martin-Baker pays all direct costs associated with the use of these facilities; however, certain indirect and overhead costs are waived based on the tested products' export value.

Has the F-18 Martin-Baker seat been previously manufactured?

Historically, Martin-Baker has been a major supplier of ejection seats to the DOD. The seat proposed for the F-18 aircraft, however, has not been manufactured previously. This seat will be based on a major redesign effort (about 40 percent) of its MK-10 ejection seat which is being manufactured for two British aircraft, the Hawk and the MRCA.

Has the F-18 Martin-Baker seat been tested and evaluated by any U.S. defense or technical authorities?

Because it has not been manuafactured, the Martin-Baker seat has n tested. Extensive testing will be required. Martin- ever, will pay the Navy approximately $500,000 for ducting these tests. (See app. I, p. 13.)

Has the British Government hindered U.S. companies' efforts to sell ejection seats in the United Kingdom?

The AV-8A/TAV-8A (Harrier) basic design incorporated an off-the-shelf Martin-Baker ejection seat. The Navy's Board of Inspection and Survey Reports on the Harrier AV-8A cited 31 major deficiencies on the Martin-Baker seat. Subsequently, the Navy contracted with Stencel to develop a seat to replace the Martin-Baker seat. After extensive testing, considered the most stringent in the history of ejection seat test programs, the Stencel seat either met or exceeded all performance requirements. The Stencel seat was the only seat in Naval service that met all the performance requirements of the Navy's ejection seat specifications. The Navy, therefore, decided to replace the Martin-Baker seat with the Stencel seat.

The Navy encountered considerable difficulty in having the Stencel seat installed in the Harrier. The British manufacturer of the Harrier originally would not accept responsibility for Stencel seat failures and, therefore, refused to install it. The Navy then directed the manufacturer to install the Stencel seat and assumed responsibility for failures. According to several Navy officials, the British Government then intervened by refusing to allow British test or ferry pilots to fly Harriers equipped with the Stencel ejection seat. As a result of this interference by the British Government, Harriers were built with Martin-Baker ejection seats, transported to the United States, and then retrofitted with the Stencel seat.

Some Navy officials believe, and we agree, that this action, at least theoretically, has hindered the efforts of U.S. companies to sell ejection seats in the United Kingdom.

Has the British Government hindered U.S. companies' efforts to sell ejection seats in the Federal Republic of Germany?

We did not find any evidence that the British Government has hindered U.S. companies' efforts to sell ejection seats in the Federal Republic of Germany.

APPENDIX III

UNITED STATES GENERAL ACCOUNTING OFFICE
WASHINGTON, D.C. 20548

PROCUREMENT AND SYSTEMS
ACQUISITION DIVISION

B-146905

JUN 12 1975

The Honorable
The Secretary of Defense

Dear Mr. Secretary:

We have completed our review of the reasonableness of prices paid for spare parts purchased from Martin-Baker Aircraft Co., Ltd., Middlesex, England, under Basic Ordering Agreement N383-73A-1375, the Navy Aviation Supply Office awarded April 29, 1973, on a noncompetitive basis. The ordering agreement was used to purchase spare parts and components for the maintenance and overhaul of Martin-Baker ejection seats used in various Army, Navy, and Air Force aircraft. Expenditures under the ordering agreement were about $8 million. In addition, during the 3 years preceding the effective date of this agreement, the Department of Defense awarded prime contracts valued at about $11.6 million to Martin-Baker.

Because of constraints the contractor placed on us, we could verify only a small part of the manufacturing cost. We were thus not able to evaluate the reasonableness of the negotiated prices included in the basic ordering agreement.

ACCESS TO RECORDS

Martin-Baker has consistently refused to submit certified cost or pricing data in support of its proposed prices for noncompetitive contracts or to accept the cost accounting standards clause in its contracts. Because of the need for these ejection seat items, the Secretary of the Navy and the Cost Accounting Standards Board have waived these requirements.

Martin-Baker's longstanding position is that neither the GAO nor any other U. S. Government agency will be permitted to review its books and records. The primary reasons given for this position are: (1) costs are not accumulated in a manner to reveal the costs applicable to just one order or contract, (2) its prices are competitive with those of other manufacturers' ejection seats, (3) no one has any right to the cost or pricing data since research and development costs were borne solely by Martin-Baker, and (4) it would take an inordinate amount of time to arrive at costs of one contract without divulging information on other customers' contracts. This

position, relative to GAO has been taken even when the contract included, as in this case, the Comptroller General's access-to-records clause.

In September 1974, however, Martin-Baker officials agreed to provide certain cost data to GAO for about 50 spare parts to be selected by GAO from the ordering agreement. The officials agreed to permit us to review the method Martin-Baker used to arrive at material costs and labor hours. Martin-Baker, however, would not allow us to audit labor and overhead rates negotiated and accepted by the United Kingdom Ministry of Defence. We selected 50 parts from the ordering agreement on a judgmental basis for which we requested supporting data.

In view of the contractor's request that our review at the plant be limited to approximately 2 to 3 days, we reduced our request to information relating to 30 parts. We were given access to material invoices, invoice data cards, labor time estimate cards, and engineering blueprints.

DATA DEVELOPED AND EXAMINED

Martin-Baker representatives told us they developed manufacturing costs of all parts by adding estimated material costs which include allowances for scrap, finishing, and profit, to the estimated labor costs which include applications for overhead, finishing, and profit. We were given detailed costs breakdowns by individual part numbers. Martin-Baker also gave us the rates for labor, overhead, scrap, finishing, and profit but stated these rates were considered to be "company confidential." Company officials said, however, that they would also give these rates to the Navy Aviation Supply Office upon request.

The following is a brief discussion of our review of the limited information provided by the contractor concerning material, labor, overhead, and profit.

Material cost estimates

Assisted by the company's design section, the contractor's estimating section engineers estimate the material cost for each part. Design section draftsmen prepare blueprints for all parts and list materials required for manufacturing. The estimators review each blueprint and ascertain current unit prices for material by (1) referring to file cards listing recent invoice prices or (2) telephone quotes if the material has not been purchased before or if the prices on the cards are too old. Finishing, scrap, and profit rates are applied to compute the costs of materials used in manufacturing.

For the selected parts we traced the more expensive material to current suppliers' invoices and invoice data cards. Although we noted several discrepancies between the cards and the invoices, the support

given us for our sample of material costs appeared, generally, to be adequate. Direct material costs, however, constituted less than 9 percent of the total manufacturing costs for our selected parts.

Martin-Baker did not give us support for the applied scrap and finishing rates. Although we obtained letters from the United Kingdom Ministry of Defence stating that it agreed to the rates, we were unable to determine the Ministry's review procedures. The contractor had previously told us that we would be expected to accept these rates and that no supporting data would be provided.

Labor cost estimates

Martin-Baker estimated labor costs by applying an average rate of all shop employees engaged in equipment manufacturing to labor hours estimated by company engineers. The contractor would not give us data supporting the hourly labor rate, other than a copy of a letter from the Ministry of Defence which agreed with the contractor's rate used to estimate manufacturing costs.

Labor-hour estimates are based on professional judgment and, after approval by the director of Martin-Baker, are entered on labor estimate cards used for reference purposes. We checked the estimated labor times given us against the labor estimate cards on file in the estimating section. Although 1 card could not be located, 29 supplied labor-time estimates were the same as those on the cards.

The contractor's representatives would not allow us to analyze and verify actual labor hours. They told us that the employees were not on piecework and that their workers' union would never allow us to review records showing actual labor time for each manufacturing process on each part. Because of these restrictions we cannot attest to the reasonableness of the labor costs.

Overhead cost estimates

The estimated overhead rate at Martin-Baker is applied to the estimated hourly labor rate to which a profit rate and a finishing rate are added to arrive at one combined hourly rate. This overall rate is then applied to the estimated labor hours to arrive at estimated manufacturing costs related to the direct labor activity involved in any particular part.

The Ministry of Defence has "provisionally" agreed to the rates for calendar years 1974 and 1975. Martin Baker is using these rates, but they are subject to the Ministry's final certification. The contractor would not give us any data supporting the overhead rates.

B-146905

Profit

The proposed profit rate by the contractor was agreed to by the Ministry of Defence and added to all estimated costs.

PROPOSED PRICE INCREASES

Martin-Baker representatives advised us that the prices negotiated for the ordering agreement represented about 63 percent of the total current manufacturing costs, which included the profit the Ministry agreed to. As a result, the officials told us they planned to negotiate prices about 50 percent higher in June 1975 for future contract agreements. Since we completed our fieldwork, we were told that the proposed price increases are greater than 50 percent.

CONCLUSION

Because of the lack of supporting cost data and because of the time constraint Martin-Baker placed on our audit, we were able to verify only a small part of the manufacturing cost for these parts. We were unable to determine the reasonableness of the prices negotiated for the items included on the basic ordering agreement.

RECOMMENDATION

Because we were unable to insure the reasonableness of the prices Martin-Baker proposed through the review and evaluation of cost or pricing data, we recommend that you consider other procurement strategies for future needs. For example, strong consideration should be given to developing another source for the items being purchased.

- - - -

We are sending copies of this report to the Chairmen, House and Senate Committees on Appropriations, Armed Services, and Government Operations and to the Chairman, Subcommittee on Priorities and Economy in Government, Joint Economic Committee. We are also sending copies to the Director, Office of Management and Budget; the Secretaries of the Army, Navy, and Air Force; the Director, Defense Supply Agency; and the Executive Secretary, Cost Accounting Standards Board.

Sincerely yours,

R. W. Gutmann

R. W. Gutmann
Director

APPENDIX IV

ASSISTANT SECRETARY OF DEFENSE
WASHINGTON, D.C. 20301

INSTALLATIONS AND LOGISTICS

21 AUG 1975

Mr. R. W. Gutmann
Director
Procurement and Systems
Acquisition Division
U.S. General Accounting Office
Washington, D. C. 20548

Dear Mr. Gutmann:

This is in reply to your letter report of June 12, 1975 concerning the reasonableness of prices paid for ejection seat spare parts purchased by the Navy from Martin-Baker Aircraft Co., Ltd., of England. Because of constraints placed by the contractor on the review, the General Accounting Office (GAO) was unable to evaluate the reasonableness of the negotiated prices. It was recommended that other procurement strategies be considered, including the development of another source. (OSD Case 4103)

Your report was referred to the Department of Navy for comment. Attached is a copy of the Navy comments. In essence the Navy advises that it would be costly as well as time consuming to develop other supply sources for spare parts. However, the Navy points out that other manufacturers of ejection seats are considered when new types of aircraft are introduced. We endorse the Navy comments.

The GAO review of this matter is appreciated and should cost data be made available in the future by Martin-Baker, you will be advised.

Sincerely,

JOHN J. BENNETT
Acting Assistant Secretary of Defense
(Installations and Logistics)

Enclosure
a/s

APPENDIX IV

Department of the Navy Comments

on

GAO Letter Report B-146905 of 12 June 1975

on

Reasonableness of Prices Paid for Spare Parts Purchased

from Martin-Baker Aircraft Co., Ltd.,

Middlesex, England

(OSD Case #4103)

I. GAO Findings and Recommendation

GAO reviewed the reasonableness of prices paid for spare parts purchased from Martin-Baker Aircraft Co., Ltd., Middlesex, England, under the Navy Aviation Supply Office Basic Ordering Agreement N383-73A-1375, awarded April 29, 1973, on a noncompetitive basis. The ordering agreement was used to purchase spare parts and components for the maintenance and overhaul of Martin-Baker ejection seats used in various Army, Navy, and Air Force aircraft. GAO states that because of constraints the contractor placed on GAO, only a small part of the manufacturing cost could be verified; therefore, GAO was not able to evaluate the reasonableness of the negotiated prices included in the basic ordering agreement.

The report notes that the United Kingdom Ministry of Defence has approved or provisionally approved Martin-Baker's labor, overhead and profit rates which Martin-Baker applies to its U. S. contracts, including the basic ordering agreement with the Aviation Supply Office. However, the report does not furnish any costing data for the parts procured under the basic ordering agreement, nor does it attempt to draw any cost comparisons between those parts and similar parts procured for competitive systems.

Since GAO was unable to insure the reasonableness of the prices Martin-Baker proposed through the review and evaluation of cost or pricing data, GAO recommends that SECDEF consider other procurement strategies for future needs. For example, strong consideration should be given to developing another source for the items being purchased.

II. Navy Comments

In view of the lack of any firm evidence that Martin-Baker spare parts costs are unreasonable and in view of the anticipated lengthy and

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costly effort required to develop competitive suppliers, the Navy does not concur that new procurement strategies are required for future procurements of spare parts to support the Martin-Baker ejection seats in inventory. However, the Navy agrees that consideration be given to developing other sources for ejection seats systems and supporting spare parts as is evidenced by the acceptance of Stencel Aero Engineering seats for the F-18, (See Table I).

III. Discussion

Procuring spare parts for ejection seats largely is governed by Navy strategy for procuring ejection seats and, once an ejection seat is procured, significant changes in its spare parts procurement requires extensive technical and production consideration, extensive time, and prohibitive cost investment.

In most instances the Navy procures ejection seats as contractor furnished equipment (CFE) within a specific aircraft weapons system. To ensure that the ejection seat and the entire aircrew escape system, of which the seat is a part, satisfy the Navy's needs, the Naval Air Systems Command has developed and is upgrading continuously its ejection seat type aircrew automated escape system specifications. These are imposed upon all new aircraft weapons systems procurements and all retrofit ejection seat escape system procurements. The specifications stress escape capability, system safety, system reliability, system maintainability, utilization of existing components, and rigorous system evaluation in order to provide Navy pilots the best possible chance for survival, reduce to a minimum system hazards to ground crew and to reduce to minimum the man-power expended upon escape system maintenance.

As a consequence of decisions made in the late 1950s and mid 1960s, as discussed under Background Information herein, almost half of today's Navy inventory of ejection seats (Table I) consists of Martin-Baker ejection seats. As also shown in Table I, the percentage of Martin-Baker ejection seats to be delivered under current aircraft weapons systems contracts currently stands at just under forty percent. Table II delineates the specific types of ejection seats, Martin-Baker and others, currently in inventory or under contract and lists the aircraft in which the systems are installed. Currently there are 10 types of Martin-Baker ejection seats in use and no new varieties under contract. Of the 10 types three (MK GRU5, MK GRUEA5 and MK H5) are being phased out by upgrading to MK7 series with significantly improved escape capability, one (MK X5) is installed in only two aircraft, and one (MK 1 Type 9A) is being replaced by the SIIIS-3 recently developed by Stencel Aero Engineering Corporation, Asheville, N. C., under Navy contracts. Thus there are 5 primary, long-term types of Martin-Baker ejection seats currently in Navy inventory and 5 short-term being phased out.

Since the Martin Baker ejection seats are proprietary developments, the Navy does not hold manufacturing drawings for the vast majority of the parts. Procurement of the necessary drawings and the subsequent

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qualification of new suppliers would be costly and time consuming, even assuming that the drawings were adequate for transfer. Reverse engineering the parts also would be extremely costly and time consuming and inherently would result in untested uncertainties as to the true interchangeability of parts. In addition, the latter effort undoubtedly would result in legal action and, quite likely, interruption of deliveries of ejection seats for production aircraft schedules. In either case, the new suppliers' parts would require thorough inspection, testing at subassembly level and at assembly level. Based upon typical costs for recent ejection seat programs, it is anticipated that the minimum nonrecurring cost to effect a significant change in spare parts suppliers for only one Martin-Baker ejection seat would be in excess of $7 million and would require at least two to three years to complete. The development of a new ejection seat system to replace only one of the Martin-Baker ejection seats would require at least $14 million and possible as much as $18 million in nonrecurring costs and at least two to two and a half years to complete service release. Pending the completion of such a program, very few systems could be installed in currently scheduled or projected production aircraft and it would be necessary to undertake a major retrofit program. Recurring costs would be at least a minimum of $40,000 per ejection seat (kit cost, aircraft modification cost, publications, etc.).

At present, in addition to their highly successful role as life saving equipment, Martin-Baker ejection seats represent a viable alternative for Navy procurements and as such serve to enhance the efforts of domestic ejection seat suppliers to be competitive in cost, weight, escape capability, safety, reliability, and maintainability.

IV. Background Information

Martin-Baker ejection seats originally were incorporated in U.S. Navy aircraft because their escape capability had been demonstrated to be markedly superior to that of then (late 1950's) existing domestic manufactured ejection seats. At that time the best domestic ejection seats were capable of providing safe escape at altitudes no lower than 200 feet terrain clearance and then only if the aircraft was wings level flying straight and level with no sinkrate. The Martin-Baker MK5 series ejection seats basically were modifications of existing Martin-Baker ejection seats having a proven groundlevel capability.

As a direct consequence of the initial decision to incorporate Martin-Baker ejection seats, the economies realizable by modifying existing installed seats as opposed to developing new replacement seats, and the lower risk to the flow of production aircraft through modifying existing seats rather than developing new replacement seats; to obtain a zero-zero escape capability for front line Navy aircraft equipped with Martin-Baker MK 5 series ejection seats, the Naval Air Systems Command undertook programs in the mid 1960s to upgrade these systems to MK 7 series configurations. As a result, aircraft currently being produced and currently constituting major segments of the Navy combat aircraft inventory are equipped with these seats.

TABLE I

30 June 1975

U.S. NAVY EJECTION SEAT STATUS

Seat Manufacturer	In-Service				Production Scheduled			
	No. Aircraft Equipped	% Aircraft	No. Seats	% Seats	No. Aircraft Equipped	% Aircraft	No. Seats	% Seats
Martin-Baker Aircraft (MK5 & MK7 Series)	1367	44.0	2665	49.6	198	40.9	430	39.3
McDonnell Douglas (ESCAPAC Series)	1385	44.5	1992	37.1	248	51.2	602	55.0
Rockwell International (ES-1, LS-1, LW-3B)	350	11.3	700	13.0	16	3.3	32	2.9
Stencel Aero Engineering (SIIIS-3)	1	(negligible)	1	(negligible)	22	4.5	30*	2.7
Miscellaneous	7	(negligible)	14	(negligible)	0	(--)	0	(--)
TOTALS	3110		5372		482		1094	

NOTE: * An additional 80 SAEC (SIIIS-3) ejection seats are on order to replace 80 MBA MK 1 Type 9 ejection seats (Harrier).

Also F-18 as proposed will be procured with an SIIIS ejection seat

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TABLE II

30 June 1975

U.S. NAVY EJECTION SEATS

Manufacturer	Type Ejection Seat	Aircraft	Remarks
Martin-Baker Aircraft Company, Ltd.	MK GRU5	A-6	Prior to AFC 119
	MK GRUEA5	EA-6B	
	MK H5	T-4	Prior to AFC 307
	MK X5	F-11A	
	MK F7	F-8	
	MKUGRU7	A-6	
	MK GRUEA7	EA-6B	
	MK GRU7A	F-14	
	MK H7	F-4	
	MK1 Type 9A	AV-8A/TAV-8A	
Douglas Aircraft Co., McDonnell Douglas Corp	ESCAPAC 1A1	A-4, C, E, L	
	ESCAPAC 1-C2	A-7	
	ESCAPAC 1-C3	TA-4, A-4F, M	
	ESCAPAC 1-E1	S-3	
	ESCAPAC 1-G2	A-7, TA-7	After ACC-23
	ESCAPAC 1-F3	A-4M/F, TA-4J/F	After AFC 489
	ESCAPAC 1-G3	A-4M/F, TA-4J/F	After ACC 256
Rockwell International	LW-3B	OV-10	
	LS-1	T-2	
	HS-1A	RA-5C	
Northrup Corp.	F-5	T-38	
Stencel Aero Engineering Corp.	SIIIS-3	AV-8A/TAV-8A	After Mod 613

NOTE: *F-18 will be equipped with an SIIIS ejection seat.