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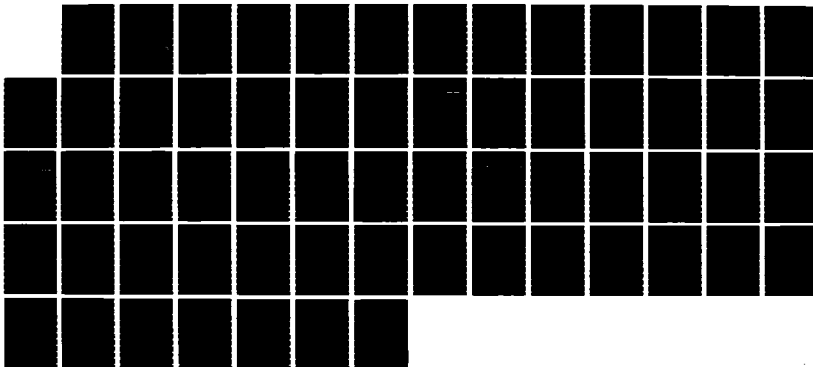
MILITARY HOUSING: ANALYSES OF OVERSEAS HOUSING COSTS  
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OFFICE WASHINGTON DC NATIONAL SECURITY AND.. 13 JUN 86  
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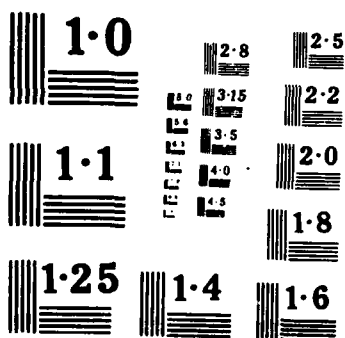
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United States General Accounting Office  
Report to the Secretary of Defense

June 1986

MILITARY HOUSING

Analyses of Overseas  
Housing Costs Are  
Misleading to  
Decisionmakers

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National Security and  
International Affairs Division

B-222176

June 13, 1986

The Honorable Caspar W. Weinberger  
The Secretary of Defense

Dear Mr. Secretary:

The House Committee on Appropriations has expressed concern about the quality of the military services' economic analyses of overseas family housing. To assess the quality of these analyses, we evaluated economic analyses issued between December 1982 and January 1984 by the Army, Navy, and Air Force. These analyses were used to identify the most cost-effective alternative for satisfying military family housing requirements in Europe. The analyses were for housing in Sigonella, Italy, where the Navy analysis showed that leasing was the preferred alternative; Bad Kreuznach, Germany, where the Army concluded that military construction was the only feasible alternative; and Torrejon, Spain, where the Air Force analysis indicated that a build to lease arrangement would be less expensive than the construction alternative.

We found the quality of these three economic analyses to be poor because of the large variety of problems they contained, the high frequency of problem occurrence, and the effects of these problems on the major conclusions of the analyses. Nine types of problems occurred a total of 16 times in the three analyses.

1. Inappropriate interest rate used in discounting costs.
2. Very limited sensitivity analyses.
3. No explanation of the special circumstance(s) present when build to lease was determined to be less expensive than military construction.
4. Unrealistically high depreciation rate assumed for U.S.-owned buildings and land.
5. Use of foreign exchange and/or inflation expectations far different from those widely accepted by professional economic forecasters.
6. No consideration of the financial viability of a recommended alternative.

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7. Use of an inappropriate method to estimate expected maintenance costs.

8. No rationale with supporting evidence given for the assumption that expected utility expenses for military construction were greater than those for build to lease.

9. Unrealistic assumption concerning the relationship between rental and sale prices of land.

The first two problems occurred in all studies, the next three each occurred in two of them, and each of the remaining problems did not occur in more than one study. All but one of the 16 problem occurrences had the effect of making leasing appear to be more attractive than was warranted. Collectively these problems were important enough to result in at least one misleading major conclusion in each study.

In performing our analysis, we identified those economic assumptions which might affect the studies' conclusions. We replaced those assumptions that we believed were questionable with assumptions we believed to be more reasonable (our base case), using data that were readily available when each service performed its analysis. We also performed sensitivity tests to determine whether our conclusions varied under different economic assumptions. Our analysis showed that:

- Even though the Navy study concluded that straight leasing was the least expensive alternative, our base case and 11 of the 12 cases in our sensitivity analysis found lease with purchase to be the least expensive alternative.
- Although the Army study concluded that using housing manufactured in the United States and erected in West Germany would cost more than leasing, but nevertheless recommended this type of housing because it was considered to be the only feasible alternative, our base case and 8 of 10 cases in our sensitivity analysis showed that U.S.-manufactured housing was less expensive than build to lease.
- The Air Force study did not analyze the financial viability of the build to lease alternative which it found to be least expensive. Our analysis indicates that this alternative may have been financially unsound for the investor. Specifically our analysis indicates that either the rent was substantially less than the mortgage payment in the build to lease alternative or the lessor had to be able to build housing at much less cost than the Air Force estimated for the military construction alternative.

In response to a directive from the House Committee on Appropriations, the Department of Defense (DOD) issued new guidance for preparing economic analyses of foreign housing. This new guidance was issued after we began our evaluation of the three studies. We reviewed this September 1984 guidance to determine the effect it would have had on the three studies we reviewed and concluded that had this guidance been in effect when these three analyses were performed, it would have lessened the severity of only one of the nine types of problems and at best would have eliminated one other. Therefore, we believe the guidance will only slightly improve the quality of future economic analyses.

## Recommendations to the Secretary of Defense

We recommend that you require all future economic analyses involving the use of the present value technique to discount (1) only current dollar expenditures, and (2) only with the average rate of interest (yield) on Treasury obligations which mature during the period of anticipated expenditures. We understand that the Office of Management and Budget is currently revising its Circular A-104 to require this type of discounting procedure. We also recommend that you request a waiver from the current version of Circular A-104 to allow you to immediately begin using this recommended discounting technique even before the official guidance is effective.

We further recommend that you issue additional guidance on conducting economic analyses of overseas family housing (1) expanding instructions on sensitivity tests, (2) requiring full explanation of the special circumstance(s) present when the build to lease alternative is found to be less expensive than the military construction alternative, (3) giving explicit directions on when and how to incorporate political risk considerations in estimates of depreciation and residual value, (4) requiring the use of expected inflation and exchange rates representative of those accepted by professional economic forecasters, (5) requiring that housing alternatives be evaluated for financial viability before they are recommended, (6) requiring a good rationale and supporting data when assumed maintenance or utility expenses in build to lease are significantly different than for military construction of approximately the same square footage, and (7) explaining how to estimate the rental and sale prices of land. These recommendations are presented in greater detail in appendix I, which also includes specific recommendations for the instructions on sensitivity tests.

## Agency Comments and Our Evaluation

The Department of Defense provided comments on a draft of this report on March 3, 1986 (see appendix III). Copies of our draft report were also provided to the Office of Management and Budget, but it did not comment. DOD agreed with much of our draft, but expressed disagreement in four major areas. DOD's comments and our evaluation are presented in full in appendix III.

DOD stated that the three analyses we reviewed are not representative of the current quality of economic analyses because they were performed before the latest Office of the Secretary of Defense (OSD) guidance was issued in September 1984. At the time we began our evaluation, each of the three studies we evaluated was the most recently available (with one minor exception) economic analysis of European housing programs performed by a military service. As previously noted, our review of OSD guidance indicated that it would not substantially improve the quality of the economic analyses. We are aware of no other evidence which would support a conclusion that DOD's analyses have improved for other reasons.

The second area of disagreement concerns inflation and exchange expectations. DOD states that, in two studies, inflation expectations were obtained by analysis of site-specific historical data. Since neither DOD nor these studies have documented these analyses, we are unable to confirm that inflation expectations were formed in this manner. DOD believes that its analysis of site-specific historical data provides a better method of projecting future housing prices than the method we used of averaging then current inflation expectations of the three major U.S. econometric forecasting firms. Lack of documentation also prevented us from determining whether DOD analyses of site-specific historical data adequately explains why this method yielded forecasts that greatly differ from those predicted by the three major U.S. econometric forecasting firms. These firms' inflation forecasts have been shown to be more accurate on the average than those based on simpler theories, such as assuming one year's inflation rate will equal that of the next year, or inflation will always equal zero.

DOD's position is that the forecast of exchange rates is at best a guess. DOD stated that there was no basis for assuming that exchange rates during a period of 20 or 30 years hence will be higher or lower than they are now. Its 1984 guidance requires that current exchange rates be held constant throughout the period of analysis. This guidance will result in exchange rate expectations that differ substantially from that used in

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our analyses, especially over those long time periods when a country's expected inflation rate greatly differs from those of its trading partners.

We believe that some forecasting methods are superior to others. Although forecasts made by the leading U.S. econometric firms have a degree of imprecision, they are not simply guesses. The exchange rate forecasts that we used were consistent with the principle of Purchasing Power Parity, believed by many professional economists to hold over periods of time as long as the studies' periods of analyses.

In a third disagreement, DOD states that only an economic analysis can determine whether build to lease will be less expensive than military construction. We believe that in most cases, the desire of a lessor to obtain profits from leasing activities and the necessity of the lessor borrowing at interest rates higher than those charged the U.S. government will cause leasing to be more expensive to the U.S. government than military construction. However, we recognize that special circumstances, five of which are listed in this report (see p. 13), can reduce a lessor's cost sufficiently to cause build to lease to be less expensive than military construction. Consequently, any economic analysis that finds leasing to be the least expensive alternative should describe the special circumstances so that the validity of the analysis can be assessed.

Finally, DOD stated that we incorrectly characterized the analyses as poor because the inappropriate interest rate used in discounting, which was responsible for two of the three analyses' results, was required by the Office of Management and Budget. We based our characterization on the many types of problems the studies contained, the high frequency of these problems, and the major effects of these problems on the studies' principal conclusions. Even had all of these problems been caused by directives originating outside of DOD, our characterization of the studies' quality would not have been changed.

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As you know, 31 U.S.C. 720 requires the head of a federal agency to submit a written statement on actions taken on our recommendations to the House Committee on Government Operations and the Senate Committee on Governmental Affairs not later than 60 days after the date of the report and to the House and Senate Committees on Appropriations with the agency's first request for appropriations made more than 60 days after the date of the report. We are sending copies of this report to the Chairmen of these Committees; Chairmen of the House and Senate Committees on Armed Services; Secretaries of the Army, Navy and Air



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Force; Director, Office of Management and Budget; and others upon request.

Sincerely yours,

A handwritten signature in cursive script, reading "Frank C. Conahan".

Frank C. Conahan  
Director



# Contents

Letter		1
Appendix I		10
Department of Defense and Military Services	Background	10
Need to Improve	Objectives, Scope, and Methodology	10
Quality of Economic	Problems in the Services' Economic Analyses	12
Analyses of Foreign	Analysis of Recent Guidance From the Office of the Secretary of Defense	27
Military Family	Conclusions	30
Housing	Recommendations	32
Appendix II		34
OSD Guidance on Consistent Methodology for Overseas Family Housing Leasing Economic Analyses		
Appendix III		39
Comments From the Assistant Secretary of Defense (Acquisition and Logistics)	GAO Comments	54
Tables		
	Table I.1: Estimated Cost of Sigonella Housing Alternatives (Present Value Measured in 1984 Dollars; Assumes 30 Years of Use.)	19
	Table I.2: Estimated Cost of Bad Kreuznach Housing Alternatives (Present Value Measured in 1984 Dollars; Assumes 25 Years of Use.)	24

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**Contents**

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Table I.3: Under-Financing of Torrejon Build to Lease Construction Cost	26
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**Abbreviations**

DOD	Department of Defense
GAO	General Accounting Office
OECD	Organization of Economic Cooperation and Development
OMB	Office of Management and Budget
OSD	Office of the Secretary of Defense

# Department of Defense and Military Services Need to Improve Quality of Economic Analyses of Foreign Military Family Housing

## Background

Evaluating alternative ways of housing U.S. military personnel and their dependents and choosing the least expensive alternative require the analytical tools of economic analysis. The "present value" technique, a method used in the analyses of investment decisions, is a decision tool that enables the analyst to total estimated future costs incurred over many years for each alternative and arrive at a single total estimated cost. This makes it possible to compare the costs of various housing alternatives even when they are incurred in different years and to identify the least costly.

The value of an economic analysis to decisionmaking depends on how well it is done. A poor economic analysis can make a higher cost alternative appear to be the least costly. The results of the present value technique depend critically upon the assumptions made. For example, incorrect assumptions about interest rates, depreciation rates on property, and exchange and inflation expectations generally cause inaccurate results. Such errors can cause the analysis to mislead a decisionmaker because the appearance of rigorous analysis lends unwarranted weight to its conclusion. Thus, it is critically important that assumptions be reasonable. In addition, they should be varied in a sensitivity analysis to give the decisionmaker some idea of whether, or the extent to which, a seemingly preferred alternative will hold up under a range of other combinations of reasonable assumptions.

## Objectives, Scope, and Methodology

We made this review to evaluate the U.S. armed services' economic analyses of foreign housing alternatives. Among the alternatives analyzed were leasing, leasing with purchase options<sup>1</sup>, and military construction. During the initial stages of this review, we selected what were then recent economic analyses of the costs of housing U.S. military personnel and their families in Europe, one for each of three services.

- 1) The Navy's November 1983 study of housing in Sigonella, Italy.
- 2) The Army's January 1984 study of housing in Bad Kreuznach, Germany.
- 3) The Air Force's December 1982 study of housing at Torrejon Air Force Base, Spain.

<sup>1</sup>In our July 24, 1985, report (GAO/NSIAD-85-113), we discussed the propriety of entering into build-to-lease agreements with buy-out provisions in foreign countries without specific legislative authority.

7 At the start of this review, we expected that considerable resources would be necessary to evaluate each analysis, and thus we chose to limit our sample to one analysis for each of the three major services. In fiscal year 1983, the Department of Defense (DOD) was authorized to lease approximately 26,000 housing units in Europe and about 3,000 in all other overseas regions. Ninety percent of the average number of leased foreign family housing units were located in Europe at that time. Because Europe clearly had the largest number of housing units, we looked at the economic analyses of European housing. In addition, we wanted our sample to be as representative of current U.S. military economic analyses of foreign family housing as possible. These three studies were the most recent available, with one exception—the Air Force study was the second most current of the five Air Force studies we collected, but we chose it because the size of the project was more than five times the size of the more recent Air Force study. The Army study was the latest of 16; the Navy study was the most recent of the five we gathered.

As an initial step in reviewing each analysis, we identified those economic assumptions which might affect its conclusions. For the Army and Navy analyses, we replaced those assumptions that we believed were questionable with assumptions we believed to be more reasonable, our base case, using data that were readily available when each service performed its analysis. We recalculated these two analyses to see if our assumptions made a substantial difference to their conclusions. We performed sensitivity tests on each of these two analyses by using other values of our assumptions to determine whether our conclusions varied under these different, economic assumptions. We did not recalculate or conduct sensitivity tests on the Air Force housing alternatives because the Air Force study's build to lease cost estimate was based on a single bid for which we were unable to obtain a replacement bid. Although the Air Force study recommended this alternative, it did not appear to be financially viable.

Finally, we looked at the guidance for economic analysis of foreign housing issued after our work began by the Deputy Assistant Secretary of Defense for Installations to evaluate how this guidance would affect the future occurrence and severity of the types of problems we found in the three economic analyses.

Our review was made in accordance with generally accepted government auditing standards.

## Problems in the Services' Economic Analyses

We found the quality of the three economic analyses to be poor because of the large variety of problems they contained, the high frequency of problem occurrence, and the effects of these problems upon the major conclusions of the studies. Nine types of problems occurred 16 times in the three economic analyses.

1. Inappropriate interest rate used in discounting.
2. Very limited sensitivity analyses.
3. No explanation of the special circumstances present for build to lease to be less expensive than military construction.
4. Unrealistically high depreciation rate assumed for U.S.-owned buildings and land.
5. Use of exchange and inflation expectations far different from those widely accepted by professional economic forecasters.
6. No consideration of the financial viability of a recommended alternative.
7. Use of an inappropriate method to estimate expected maintenance costs.
8. No rationale with supporting evidence given for the assumption that expected utility expenses for military construction were greater than those for build to lease.
9. Unrealistic assumption concerning the relationship between the rental and sale prices of land.

All but one of the 16 occurrences of these problems had the effect of making leasing appear to be more attractive than was warranted. As a result of these problems, we believe that the results of all three economic analyses are misleading to decisionmakers.

- Even though the Navy study concluded that straight leasing was the least expensive alternative, our base case and 11 of the 12 cases in our sensitivity analysis found lease with purchase to be the least expensive alternative.
- Although the Army study concluded that using housing manufactured in the United States and erected in West Germany would cost more than

leasing, but nevertheless recommended this type of housing because it was considered to be the only feasible alternative, our base case and 8 of 10 cases in our sensitivity analysis showed that U.S.-manufactured housing was less expensive than build to lease.

- The Air Force study did not analyze the financial viability of the build to lease alternative which it found to be the least expensive. Our analysis indicates that this alternative may have been financially unsound for the investor. Specifically our analysis indicates that either the rent was substantially less than the mortgage payment in the build to lease alternative or the lessor had to be able to build housing at much less cost than the Air Force estimated for the military construction alternative.

The results of these three studies should have been questioned when build to lease was found to be less expensive than construction. In a leasing arrangement, a middleman enters the agreement only if he/she expects to make a profit over the years. In addition, to assemble project financing, it is extremely likely that the middleman must borrow at a higher interest rate than the U.S. government because he/she is a greater risk to lenders. As a result, if everything else is equal, the cost of leasing should be more expensive to the U.S. government than military construction unless special circumstances reduce the lessor's cost sufficiently to offset the profit margin and interest rate disadvantages, such as (1) the leased housing is of lesser quality, (2) the leased housing design is superior to or uses construction methods more economical than those used in military construction,<sup>2</sup> (3) lessors receive substantial foreign tax advantages which in effect shift some of the cost of the housing to the host country, (4) U.S. residency is expected to be short term and the expected resale price unfavorable, or (5) labor costs to build leased housing are substantially less than for purchased housing. Consequently, any economic analysis that finds leasing to be a less expensive long-term alternative than construction should fully explain the special circumstance(s) present so that the validity of its results can be assessed.

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## Navy Study

The Navy's Sigonella study considered four alternatives for 200 family housing units: (1) lease, (2) lease with purchase in the 5th year, (3) military construction on leased land, and (4) military construction on purchased land. The Navy's analysis, which concluded that straight leasing

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<sup>2</sup>In this special circumstance the obvious question is, what constrains the military construction alternative from using the superior design and/or construction methods?



was the least expensive alternative,<sup>3</sup> made a number of assumptions with which we disagree. We redid this economic analysis using assumptions we believed to be more reasonable and information that was readily available when the Navy performed its analysis. We found that lease with purchase in the 5th year was the most economical alternative; it was also the preferred alternative in 11 of the 12 alternative scenarios in our sensitivity analysis. Varying the period of analysis was the only sensitivity test performed by the Navy study. No special circumstances were presented in the Navy study.

Four critical assumptions in the Navy study, with which we disagree, caused straight leasing to appear to be the least expensive alternative: (1) the method of discounting, (2) the formulation of exchange and inflation expectations, (3) the high depreciation rate on U.S.-owned buildings and land, and (4) the relationship between the rental price of land and its sales price.

The study overestimated the attractiveness of straight leasing by discounting at too high an interest rate. The 10 percent real discount rate used in the Navy study was based on the rate prescribed by Office of Management and Budget (OMB) Circular A-104.<sup>4</sup> The rate prescribed by OMB is applied to constant dollar expenditures. (Constant dollars correct for changes in the purchasing power of the dollar due to inflation.) In contrast, we believe that the U.S. government's cost of borrowing is the appropriate rate at which to discount when conducting present value analyses for determining the alternative most cost-effective to the U.S. government. Consequently, it is our policy to discount current dollar expenditures using the average rate (yield) on Treasury obligations which mature during the period of anticipated expenditures. (Current dollars do not correct for changes in the purchasing power of the dollar due to inflation.) Thus the discount rate prescribed by OMB comparable to that which we recommend is 10 percent plus the expected rate of inflation. Since the U.S. government's market rate of interest is usually only a few percentage points higher than expected inflation rates, OMB's prescribed policy imposes an interest rate for government decision-making that substantially exceeds market values.

<sup>3</sup>The Navy included a buy-out provision in the lease it signed in January 1984 as a result of a directive from the House Committee on Appropriations; the Committee in August 1982 stated that it did not intend to approve any new foreign lease agreements costing more than \$12,000 per housing unit per year unless they contained options to purchase.

<sup>4</sup>The Navy study complied with DOD Instruction 7041.3 of October 18, 1972. This DOD instruction translated the 7 percent after tax real interest rate prescribed by OMB Circular A-104 into a 10 percent before tax real rate.

The Comptroller General's May 19, 1983, letter to the Director, OMB, explained our policy on discounting and suggested changes to OMB Circular A-104 which would require executive agencies to discount using this method.<sup>5</sup> To date, OMB has not revised this circular, although it has drafted a revision which specifies a method of discounting compatible with the method we recommended. However, until the revision is effective the services are required to continue discounting differently than we suggest, although when DOD considers long-term leasing for aircraft and naval ships, it is currently required by OMB and the Treasury to discount current dollar expenditures with market rates of interest charged the Treasury (plus 1/8 percent).<sup>6</sup>

The Navy analysis discounted the expected constant dollar expenditure streams with a real interest rate of 10 percent, a rate substantially greater than the 5.3 percent real interest rate the U.S. government was then charged. Thus, the relative cost of straight leasing was underestimated because too high an interest rate reduces costs late in the period more than it does those early in the period, and straight leasing is the alternative with the greatest percentage of its costs occurring late in the period of analysis.

The exchange and inflation expectations of the study also made straight leasing appear to be more attractive than was warranted. With prices measured in dollars, the study assumed that the inflation rate of Italian goods would be 5-1/2 percent a year lower than the inflation rate on U.S. goods.<sup>7</sup> This expectation is markedly different from those of the three major econometric forecasting firms in the United States. On average, they expected inflation on Italian final goods and services to equal the inflation on American goods when the prices of each country's final goods and services are measured in dollars. Additional support for the lower inflationary forecasts of these firms is provided by the (relative version of the) principle of Purchasing Power Parity, which is

<sup>5</sup>This letter is reprinted in Improved Analysis Needed to Evaluate DOD's Proposed Long-Term Leases of Capital Equipment, Appendix VII (GAO/PLRD-83-84), June 28, 1983.

<sup>6</sup>See "Joint OMB and Treasury Guidelines to the Department of Defense Covering Lease or Charter Arrangements for Aircraft or Naval Vessels," Oct. 31, 1984.

<sup>7</sup>The study assumed that in the long-run U.S. inflation would average 9 percent a year, Italian (lira) inflation would average 15 percent a year, and the lira would depreciate against the dollar at an average rate of 11.25 percent a year. The study was ambiguous on how it calculated these expectations but implied that they were obtained by analysis of the prior 8-year period. At the time of the study, the three major U.S. econometric forecasting firms (Chase Econometrics, Data Resources Inc., and Wharton Econometric Forecasting Associates) had long-run forecasts, on the average, of 5.3 percent a year for U.S. inflation, 10.4 percent a year for Italian inflation, and the lira depreciating against the dollar at a rate of 4.8 percent a year.

believed by many economists to hold over long time periods. This principle states that the relative purchasing power of one currency compared to another will be maintained over time. Thus in the specific case of the United States and Italy, this principle requires the exchange rate to adjust so that, when prices are measured in dollars, the average inflation on Italian goods approximates that on American goods during a period as long as the study's period of analysis. If either of these two forecasting methods more acceptable to the economic forecasting profession had been used, expected Italian inflation would have been relatively higher than the study assumed. Consequently, straight leasing would have appeared to have been less attractive than the study estimated because higher inflation rates affect costs late in the period more than costs earlier in the period of analysis, and this alternative has the highest percentage of its costs late in the period of analysis.

The study also overestimated the desirability of straight leasing by assuming that the real value to the United States of the land and structures it owns will be zero at the end of the 30-year period of analysis. This is equivalent to 100-percent real depreciation over the 30 years. This contrasts with the 32-percent real depreciation over 30 years for U.S. private residential housing (1.28 percent a year, declining balance) estimated by Wykoff and Hulten's extensive study of depreciation for the Treasury.<sup>8</sup> The Navy study assumed depreciation that is also much higher than the 1.7 percent a year depreciation rate for structures and 1.5 percent a year appreciation rate on land currently mandated by guidance issued by the Office of the Secretary of Defense (OSD). The Navy study was performed before this guidance was issued. This OSD guidance requires 40-percent real depreciation for structures and 56-percent real appreciation for land over 30 years.

The relevant cost concept for determining which alternative is least expensive is the "cost of use" during the period of analysis. Measuring all cost concepts in present value, the cost of using a property during the analysis period equals the total cost of the property minus the value to the United States of this property at the end of the period of analysis, its residual value. The study justified its assumption of zero residual value by arguing that the government of Italy does not believe that the Bilateral Infrastructure Agreement of 1954 requires it to purchase these facilities. The study therefore implicitly assumed that the United States

<sup>8</sup>Wykoff, Frank E. and Hulten, Charles R., *Tax and Economic Depreciation of Machinery and Equipment: A Theoretical and Empirical Appraisal*, U.S. Treasury, Office of Tax Analysis, Phase II Report, July 26, 1979. (Wykoff and Hulten obtained this estimate of residential housing for the Treasury by averaging all professionally recognized estimates then current.)

could neither sell the land and buildings to the government of Italy or to a private party nor could it use this property after the period of analysis. We believe that this is unlikely to happen, and consequently this assumption biases the Navy's results toward preferring straight leasing by overestimating the use costs of the other three alternatives. Even if the Navy no longer needed this housing, we believe the U.S. government would be able to sell this U.S.-owned property. Lack of a guarantee of sale in this agreement does not imply that the U.S. government is unlikely to use these facilities after the period of analysis or, barring that, the government of Italy is unlikely to purchase the housing and land itself or to allow a private party to purchase them.

Consequently, in our analysis we assumed there will be no real depreciation on land and a 1.5 percent a year declining balance real depreciation rate on structures in our base case. (See footnote a of table I.1.) The Navy study stated that its results were contingent upon the political risk argument but did not test this assumption in a sensitivity analysis; consequently a decisionmaker would not know the degree to which Navy's results were affected by this assumption. We tested the effect of assuming zero residual value on our results and found that, in and of itself, this assumption did not change our results.<sup>9</sup>

The study overestimated the attractiveness of straight leasing and military construction on purchased land by assuming that annual land rent for the other two housing alternatives (lease with purchase in the 5th year and military construction on leased land) would be 15 percent of the land's market price. No rationale was given for this assumption. If land is treated as a capital good with a zero real rate of depreciation and it is assumed that land prices inflate at the same rate as other goods and services, then a leading theory of investment implies that the annual rental price of land divided by its sales price equals the real interest rate, a rate that was substantially less than 15 percent at the time of the Navy study.<sup>10</sup> If land prices are expected to inflate faster than the prices of other goods and services, then the annual land rent divided by the price of land would be even lower than the real interest rate. At the time of the Navy study, estimates by the three major U.S. econometric forecasting firms of the real interest rate averaged 5.3 percent. Consequently, this assumption by the Navy caused straight leasing and

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<sup>9</sup>The zero residual value assumption reduces the cost advantage of lease with purchase over straight leasing to \$0.58 million from the \$1.92 million cost advantage of our base case in table I.1.

<sup>10</sup>Hall, Robert E. and Jorgenson, Dale W., "Tax Policy and Investment Behavior," American Economic Review, June 1967, pp. 391-414.

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**Appendix I**  
**Department of Defense and Military Services**  
**Need to Improve Quality of Economic**  
**Analyses of Foreign Military Family Housing**

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military construction on purchased land to appear relatively more attractive than was warranted because it caused the rental costs of land for the other two alternatives to be overestimated.

We analyzed the four housing alternatives in the Navy study. We altered a number of assumptions with which we disagreed but continued to use certain basic information contained in the study. Table I.1 presents our base case results, those of the Navy study, and the results of our sensitivity analysis when the period of analysis is 30 years.<sup>11</sup> In our base case, we found lease with purchase to be the least expensive and straight leasing to be the most expensive, just the opposite of the Navy's results. In 11 of 12 cases in our sensitivity analysis, lease with purchase continued to be the least expensive alternative.<sup>12</sup>

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<sup>11</sup>The Navy study had two periods of analysis, 10 years and 30 years, and found no major differences between them.

<sup>12</sup>We used 31 different periods of analysis that differed only in their ending dates. The ending dates were all between 20 and 50 years after they began. The results of our analysis reported in table I.1 are representative of our results from these other periods of analysis.

Appendix I  
Department of Defense and Military Services  
Need to Improve Quality of Economic  
Analyses of Foreign Military Family Housing

**Table I.1: Estimated Cost of Sigonella Housing Alternatives** (Present value measured in 1984 dollars. Assumes 30 years of use.)

Dollars in millions

Case	Differing assumption from base case	Straight lease	Lease with purchase	Construction on	
				Leased land	Purchased land
Navy study	Many <sup>a</sup>	\$ 9.26	\$12.18	\$11.29	\$11.31
GAO base case	None	19.67	17.75	18.61	18.63
<b>Sensitivity case</b>					
1	Interest rate = 2% higher	16.30	16.14	16.98	17.06
2	Interest rate = 2% lower	24.31	19.60	20.41	20.32
3	Land rent = 6% current selling price	19.67	17.82	18.66	18.63
4	Land rent = 4% current selling price	19.67	17.69	18.56	18.63
5	Dollar inflation = 3% per year higher	27.50	20.50	21.22	21.03
6 <sup>b</sup>	Dollar inflation = 3% per year lower	14.96	15.49	16.33	16.44
7	Lira inflation = 3% per year higher	19.35	17.60	18.48	18.50
8	Lira inflation = 3% per year lower	20.00	17.91	18.75	18.76
9	Real depreciation rate on structures = 1.75% per year declining balance	19.67	17.84	18.71	18.72
10	Real depreciation rate on structures = 1.28% per year declining balance	19.67	17.68	18.52	18.54
11	Rent 20% greater	22.00	18.40	18.67	18.63
12	Rent 20% less	17.33	17.11	18.56	18.63

<sup>a</sup>The following important assumptions differentiate GAO's base case from the Navy study. (1) We discounted current dollar expenditures with an average yield on Treasury obligations, 11.11% at the time of the Navy study, which implies a real yield of approximately 5.3 percent. The Navy study discounted constant dollar expenditures with the high nonmarket real yield of 10 percent. (2) We assumed there is no real depreciation on land and a 1.5% per year declining balance real depreciation rate on structures, thus 30 years later, structures would be worth 64% of their original real cost. The Navy assumed that neither the land nor the structures have a residual value to the U.S. government. We chose a somewhat higher rate than the Treasury estimate of 1.28 percent per year declining balance because the Treasury estimate has a significant number of owner-occupied homes while these homes will not be owner-occupied. (3) We averaged exchange rate growth and inflation forecasts of the three major U.S. econometric forecasting services that were available at the time of the Navy study. When we needed forecasts further in the future than any of these services provided, we assumed (a) an annual inflation rate equal to the average rate during the most future 10-year period forecast by the service(s) and (b) that the exchange rate adjusted so that the principle of Purchasing Power Parity continuously held. The Navy study implies that the forecasts it used were based on its analysis of the prior 8 years. (4) We assumed annual land rent to be 5.3% of current selling price, while the Navy study assumed it to be 15%.

<sup>b</sup>Our only case for which lease with purchase is not the least expensive alternative.

## Army Study

The Army's Bad Kreuznach study considered three alternatives for 100 family housing units: (1) economy housing—families rent private housing in this rural German community and receive housing allowances, (2) construction—housing manufactured for the Army in the United States and then shipped and erected in Germany, and (3)

build to lease—a private firm builds and rents this housing to the Army. Economy housing and build to lease were not feasible according to the study. The local German economy has a very tight housing market, so economy housing is unavailable. Private investors have been unwilling to finance the build to lease alternative due to then new German tax laws. Consequently, there was no need for the Army study to perform a present value analysis because military construction was the only feasible alternative; however, it made a present value analysis for all three alternatives and found economy housing to be the least expensive and construction the most expensive.

To evaluate the Army's economic analysis, we made a present value analysis of the three housing alternatives using assumptions we believed to be more reasonable and information that was readily available when the Army performed its analysis. In contrast to the Army study, we found build to lease to be slightly more expensive than construction in our base case. In 8 of the 10 cases in our sensitivity analysis, construction continued to be less expensive than build to lease. Economy housing continued to be the least expensive alternative, except for two sensitivity cases.

The Congress required the Army to purchase manufactured housing in the United States and then ship it to and erect it in West Germany rather than use conventional construction methods in which housing is built on the site.<sup>13</sup> We estimated that conventional construction methods would have been \$400,000 less expensive, using a period of analysis of 25 years.

Three assumptions in the Army study with which we disagree made the construction alternative appear to be more expensive than build to lease: (1) the method of discounting, (2) the method of determining maintenance costs, and (3) the estimates of utility expenses.

Another assumption implicit in the Army study with which we disagree tended to decrease the Army's estimated cost of the construction alternative and increase the estimated cost of build to lease—the implicit expectation that German residential construction would appreciate in price approximately 3 percent a year faster during the 25-year period of analysis than would German goods and services in general.

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<sup>13</sup>The fiscal year 1984 Military Construction Authorization Act (P.L. 98-115, Oct. 11, 1983) requires that at least 90 percent of new military construction housing in a foreign country be housing manufactured in the United States.

The first three assumptions, as a group, had a larger effect upon the Army study than did this last assumption.

The Army study overestimated the attractiveness of economy housing and build to lease by discounting at too high an interest rate. It discounted constant dollar expenditures using a real interest rate of 10 percent, although real interest rates on Treasury obligations were substantially less. The Army study discounted just as the Navy study did, and for the same reasons as the Army study caused straight leasing to appear to be more attractive than it was. This use of too-high an interest rate caused build to lease and economy housing costs to be reduced more than construction's because too-high an interest rate lowers costs incurred late in the period relatively more than those earlier in the period and these two alternatives have larger percentages of their costs late in the period of analysis.

The Army study assumed that the cost of construction, the residual value of the military construction alternative, and the build to lease rental payments would increase in price approximately 3 percent a year faster than would German goods and services in general. No justification was given or sensitivity tests performed on these assumptions.

The appropriateness of this assumption depends upon whether or not it was reasonable to expect that, during the 25-year period of analysis, German residential construction would escalate in price 3 percent a year faster than would German goods and services in general. We looked at historical residential construction prices as well as those for goods and services in general in 17 Organization of Economic Cooperation and Development (OECD) member countries, including Germany and the United States. We also averaged the long-term forecasts of German residential construction inflation relative to German goods and services in general predicted by the three major U.S. econometric forecasting firms at the time of the Army study. Using each of these methods, we concluded that the Army's implicit expectation of 3 percent a year additional inflation for German residential construction was unreasonably high.

Between 1970 and 1982, the longest period for which residential construction prices were readily available for many OECD countries, the average inflation rate for 17 of these countries, including West Germany and the United States, was 0.95 percent a year higher for residential construction than for goods and services in general. During this period, West Germany's construction inflation exceeded that of its aggregate



goods and services by 0.90 percent per year; the corresponding West German figure for the 19-year period from 1964 to 1983 was 0.93 percent a year.

The three U.S. econometric forecasting firms also expected less additional inflation for German residential construction than the Army assumed in its study<sup>14</sup>—only 0.99 percent a year on the average from 1984 to 2000.

The Army study's implicit expectation of unreasonably high additional inflation for German residential construction caused the cost of build to lease to be substantially higher than was warranted and the cost of military construction to be substantially lower. Economy housing was unaffected because none of its costs were affected by this assumption. This assumption increased the total cost of build to lease because it increased rental payments for this alternative. Because construction occurs only during the first 3 years of the period of analysis, this assumption of 3 percent a year additional German residential construction inflation increased construction costs of the military construction alternative relatively little. In contrast, since the residual value is measured for the end of the period of analysis, this excessive rate of relative inflation over many years greatly increased the resale price of the building and thereby the residual value. This large increase in residual value lowered the use cost of the military construction alternative substantially more than the slightly higher construction cost increased this alternative's total use cost. We measured the effects of this assumption upon the base case (see table I.2) of our analysis of the three housing alternatives. This assumption of 3 percent additional inflation increased build to lease costs by \$1.69 million and decreased the total use cost of military construction by \$1.42 million when the period of analysis was 25 years.

The study estimated that maintenance and repair costs for construction would exceed those for build to lease. Without good evidence to the contrary, we believe it is reasonable to assume that the expected maintenance and repair costs for the two alternatives are essentially equal because the U.S. government is responsible for such costs under both alternatives. The construction maintenance and repair cost schedule was calculated from the Army's fiscal year 1983 average maintenance and

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<sup>14</sup>Wharton Econometrics Forecasting Associates and Data Resources Inc. forecast 10 and 11 year periods, respectively. Chase Econometrics forecast a 16-year period. Therefore to calculate an average forecast for these firms, we extended the forecasts of Wharton and Data Resources to a 16-year period, assuming that had they forecast for the entire 16-year period, differences in the three firms' forecasts would have continued at the same level.

repair cost for all of its 30-year old, on-post housing units, while the build to lease schedule was calculated from the Army's 1983 average maintenance and repair costs for 10-year old build to lease units. Thus, each cost schedule estimate was calculated from a single data point, but each data point differed from the other, not only in that one was for build to lease and the other was not but also in the buildings' ages. Since older buildings generally have greater maintenance and repair costs than newer buildings, the study's claim that maintenance and repair costs for construction can be expected to be greater than for build to lease is not justified by the evidence. The Army study's use of this assumption made the build to lease alternative appear to be relatively more attractive than was warranted.

In the Army study, costs for the same utilities based upon the same square footage of housing were estimated to be 19 percent greater for the construction alternative than for build to lease. No rationale was given for this assumption. We believe that the utility costs should be assumed to be the same for both alternatives unless a good rationale with supporting data is provided.

The sensitivity analysis performed by the Army study was very limited. The study varied only two of the six variables that we varied in our sensitivity analysis.<sup>15</sup>

To evaluate the Army's economic analysis, we analyzed the three housing alternatives in the Army study, even though only the construction alternative appeared to be feasible. We changed the major assumptions in the study with which we disagreed; we also performed a sensitivity analysis, using data that was readily available at the time the study was performed. Table I.2 presents the results of our base case, those of the Army study, and those of our sensitivity analysis when the period of analysis is 25 years.<sup>16</sup> In our base case and in 8 of 10 cases in our sensitivity analysis, build to lease was more expensive than construction, just the opposite of the Army study's conclusion.

<sup>15</sup>The Army study varied the period of analysis; it also calculated the effect of 100 percent depreciation. The rest of its sensitivity analysis answered the question: How much of a percentage (1) increase in the rent of build to lease or (2) increase in rent as well as maintenance and repair of build to lease or (3) decrease in building costs of the military construction alternative were necessary for it to be less expensive than build to lease?

<sup>16</sup>We used 31 different periods of analysis which differed only in their ending dates. The ending dates were all from 20 to 50 years after they started. Our results for the 25-year period of analysis in table I.2 are representative of our results for these 30 other periods of analysis.

**Appendix I**  
**Department of Defense and Military Services**  
**Need to Improve Quality of Economic**  
**Analyses of Foreign Military Family Housing**

**Table I.2: Estimated Cost of Bad Kreuznach Housing Alternatives** (Present Value Measured in 1984 Dollars; Assumes 25 Years of Use)

Dollars in millions

Case	Differing assumption from base case	Construction	Build to lease	Economy
Army study	Many <sup>a</sup>	\$ 9.55	\$ 7.09	\$ 5.82
GAO base case	None	10.05	11.72	8.44
<b>Sensitivity case</b>				
1	Interest rate = 2% higher <sup>b</sup>	10.00	9.70	7.14
2	Interest rate = 2% lower	9.84	14.43	10.17
3	Dollar inflation = 3% per year higher	9.29	16.67	11.19
4	Dollar inflation = 3% per year lower <sup>b</sup>	10.02	8.71	6.58
5	Mark inflation = 3% per year higher	10.05	11.48	8.44
6	Mark inflation = 3% per year lower	10.04	11.98	8.44
7	Additional residential construction inflation 1% per year higher	9.43	12.51	8.44
8	Additional residential construction inflation 1% per year lower	10.53	11.03	8.44
9	Real depreciation rate on structures = 1.75% a year declining balance	10.11	11.72	8.44
10	Real depreciation rate on structures = 1.28% a year declining balance	9.83	11.72	8.44

<sup>a</sup>The following important assumptions distinguish our base case from the Army study: (1) We discounted current dollar expected expenditures with the average yield on outstanding Treasury obligations at the time of the Army study of 10.88% implying a real interest rate of approximately 5.1%; the Army study discounted constant dollar expenditures with the high real yield of 10%. (2) We averaged forecasts available at the time of the Army study, by the three major U.S. econometric forecasting firms for additional German residential construction inflation (see footnote 14). Because we needed a forecast beyond the year 2000, the last year any of these firms forecast, we obtained it by assuming that the average forecast of these firms for the period 1991 to 2000 continued thereafter. We obtained a forecast with an average additional German residential construction inflation rate of 1.01% per year over a 25-year period of analysis compared to the Army study's approximately 3% per year. (3) The Army study assumed that maintenance and repair costs were much more expensive and utility costs 19 percent more expensive for construction than build to lease; we applied the same estimates of these two costs to each of these housing alternatives.

<sup>b</sup>Cases for which the military construction alternative is not less expensive than build to lease.

## Air Force Study

The Air Force's Torrejon study considered three alternatives for 800 family housing units: (1) build to lease, (2) construction, and (3) continue to lease marginally adequate housing. Two discounting methods were used—one discounted constant dollar costs with a real interest rate of 10 percent, which was substantially greater than the approximately 5.25 percent real interest rate then charged the U.S. government; the other discounted current dollar costs with an interest rate approximately 1.3 percent less than the financial markets were then charging.

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**Appendix I**  
**Department of Defense and Military Services**  
**Need to Improve Quality of Economic**  
**Analyses of Foreign Military Family Housing**

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Only the interest rate was varied in the sensitivity analysis. Both methods of discounting found build to lease the least expensive and the continued leasing of older housing the most expensive. No special circumstance was given to explain the study's finding. The study unequivocally recommended the build to lease alternative, and 2 weeks later a build to lease contract obligating the same rental payments as those assumed in the study was signed.

The lessor had not obtained financing 6 months after the lease was signed, and the lease was amended, with the U.S. government obligated to higher rental payments.<sup>17</sup> In October 1984, the Air Force terminated the lease agreement because the lessor still had not obtained the necessary financing. Currently the Air Force plans to solicit new bids for the project.

The major problem with the study is that it did not analyze the financial viability of the build to lease alternative. Our analysis indicates that this alternative may have been financially unsound for the investor. Specifically our analysis indicates that the rent assumed for the "build to lease alternative" would not be sufficient to pay the mortgage on the estimated building costs of the "construction alternative"—thus either (1) the cost of building the "build to lease alternative" was substantially less than that estimated for the "construction alternative" or (2) the "build to lease alternative" was not financially viable. We demonstrate this conclusion by presenting results from our analysis in table I.3. Nine cases are presented in the table using three different lengths of time for the mortgage and three different percentages of owner financing. In all nine cases, the rent is clearly insufficient to sustain a large enough mortgage for the build to lease alternative to be financially viable when (1) build to lease construction costs are equal to those estimated by the Air Force for the military construction alternative, (2) the mortgage interest rate is equal to the market rate expected, on average, by the three major U.S. econometric forecasting firms at the time the Air Force study was performed, and (3) all rental payments are used to pay the mortgage. Since the lessor has costs in addition to mortgage payments, this last assumption causes our analysis to overestimate the size of the mortgage sustainable by the rent and therefore underestimate the degree to which this alternative is under-financed. Not addressing the financial viability of build to lease caused the study's results to be biased toward choosing this alternative. We were unable to redo the Air Force analysis because

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<sup>17</sup>This took the form of setting up a fixed schedule of lease payments in Swiss francs, a currency that all three major econometric forecasting services expected to appreciate against the dollar.

we were unable to obtain information on a viable substitute build to lease bid in place of the single bid upon which the Air Force estimate was based.

**Table I.3: Under-Financing of Torrejon Build to Lease Construction Cost<sup>a</sup>**

Duration of mortgage (years)	(Percent of construction cost)		
	Owner financing	Mortgage financing <sup>b</sup>	Under-financing
12	5	49.1	45.9
22	5	63.0	32.0
32	5	68.8	26.2
12	10	49.1	40.9
22	10	63.0	27.0
32	10	68.8	21.2
12	20	49.1	30.9
22	20	63.0	17.0
32	20	68.8	11.2

<sup>a</sup>The total of owner financing, mortgage financing, and under financing is 100% of the construction cost.

<sup>b</sup>Maximum mortgage size sustainable by rental payments assumed by the Air Force study for build to lease.

Another problem with the Air Force study is that it caused straight leasing of marginally adequate housing to appear more attractive than was warranted because it did not calculate the residual value of the two other alternatives. In this way, the Air Force implicitly assumed 100 percent depreciation over the period of analysis for the land and structures. The United States had ownership rights in these two other alternatives, and therefore each had positive residual value. Consequently, the study overestimated the "cost of use" of the build to lease and military construction alternatives. The Air Force stated in its study that it knew that the residual value of these two alternatives differed from the zero residual value for the continued leasing of marginally adequate housing but gave no justification for ignoring the residual values in its procedure.

## Analysis of Recent Guidance From the Office of the Secretary of Defense

The House Committee on Appropriations in June 1984 directed OSD to develop and implement a methodology based on realistic assumptions for use in economic analyses of foreign housing lease agreements. The stated purpose of this directive was to increase the realism and consistency of these analyses.<sup>18</sup> In response, the Deputy Assistant Secretary of Defense for Installations issued guidance for economic analysis of leasing overseas family housing in September 1984. (See app. II.) The OSD action officer for this guidance believes it to be the only guidance issued by OSD on this subject in more than 10 years. We found that this guidance would have lessened the severity of only one of the nine types of problems, the high depreciation rate on buildings and land, that we found in the three studies and would have eliminated at best one other, the very limited sensitivity analyses, had it been in effect when these analyses were performed. The guidance addresses only two other problems. Consequently, we believe this guidance will improve only slightly the quality of the economic analyses of overseas housing.

The OSD guidance substantially lowers the depreciation rate on buildings to 1.7 percent a year, declining balance, a level reasonably close to estimates in several professionally recognized studies of residential housing in the United States. It also requires analysts to assume a real appreciation rate on land of 1.5 percent a year. It requires that these rates be used apparently without exception. Had this guidance on depreciation been in effect when the three studies were performed and had the services issued identical instructions and otherwise ensured that this guidance was followed, we believe the problems with too-high depreciation rates used in the Navy and Air Force studies would not have occurred. However, because OSD guidance does not tell the services when or how to account for political risk in calculating residual value, we believe it is incomplete. Unless additional OSD guidance is issued on accounting for political risk in computing residual value, we foresee two types of errors occurring.

1. If the analysts ignore political risk when this risk is large enough that it should not be ignored, the analysis will overestimate residual value. For example, if the political risk of loss of base rights is very high, then it should be reflected in a higher depreciation rate for structures and lower appreciation rate (or greater depreciation rate) for land and thus

<sup>18</sup>See H. R. Rep. 98-850, June 20, 1984, p. 57, which accompanied the 1985 Military Construction Appropriations Bill (H.R. 5898, 98th Congress). The Senate Appropriations Committee agreed with the House Committee that DOD needed to continue to refine and implement a consistent methodology for these economic analyses of the cost of foreign housing. See S. Rep. 98-567, July 26, 1984, pp. 47 and 48.

lower residual value. This type of error is likely to occur when a service follows recent OSD guidance exactly.

2. If the analysts overestimate political risk, they may underestimate residual value. For example, the Navy accepted what we believe to be a faulty political risk argument in its study, resulting in an estimate of zero residual value (100-percent depreciation) for U.S.-owned buildings. This type of error could occur when a service formally or otherwise institutes its own policy on how to handle political risk.

While precise measurements of political risk may not be available, it is a real phenomenon that should be addressed. Consequently, OSD should include explicit instructions on when and how to incorporate political risk in estimates of residual value and should require that when residual value is lowered by political risk considerations, political risk must be varied in the sensitivity analysis.

OSD guidance would not have eliminated the problem of discounting with an inappropriate interest rate in the three economic analyses. The guidance requires that the present value analysis be done in two ways: (1) discount constant dollar expenditures with a real interest rate of 10 percent, which was done in all three analyses, and (2) discount current dollar expenditures with a 10 percent nominal interest rate, which the Air Force analysis also did.<sup>19</sup> Since neither method requires that the discounting use the market rate of interest, each method biases the analysis—toward leasing when the interest rate used is higher than the market rate and toward the construction alternative when it is lower. Even if the two interest rates used bracket the market rate, the difference between them will probably be quite large if history is any guide and substantial imprecision will be introduced into the analysis.

We also believe that OSD guidance will not improve inflation and exchange rate expectations in future analyses for the following reasons.

- It requires analysts to use unrealistic exchange rate expectations because it requires them to assume that throughout the 25-year period of analysis the exchange rate will remain constant at a level previously forecast by DOD when it formulated its budget request for the current fiscal year. The period of analysis is so long that significant changes in

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<sup>19</sup>This second method of discounting is not consistent with OMB Circular A-104 which DOD has interpreted to mean the first method of discounting. A waiver to Circular A-104 has been granted for the analyses of the leasing of naval ships and aircraft (see pp. 19-20).

the exchange rate should be expected. As a result, future analyses will use expected exchange rates which could significantly differ from that of professional forecasters particularly when, as often occurs, the expected inflation rate of U.S. goods and services significantly differs from the expected inflation rate of foreign goods and services.

- It is too general on inflation expectations. It gives no instructions on which foreign inflation indices or U.S. inflation index to use when calculating expenditures other than rent.
- It is confusing on inflation expectations. An instruction on estimating future rent increases states, "Estimates for lease renewal will escalate previous term lease costs by the OSD/OMB overseas inflation indices." The action officer for this guidance said that the inflation indices referred to are series which have been identified by the Director for Plans and Systems in DOD's Office of the Comptroller (who is responsible for creating DOD's price and inflation series from OMB economic assumptions) as domestic (not foreign as the name seems to imply) price escalation series. We believe that in this circumstance, foreign price escalation series (sometimes modified by exchange rate expectations) should be used.

The OSD guidance could lessen the problem of nonexistent or very limited tests in the sensitivity analysis. However, it is *too general to totally* remedy this problem. Had the guidance been in effect when the three analyses were performed, it is likely that some sensitivity tests which should have been performed would not have been performed while others would not have been performed correctly. The guidance requires that these sensitivity tests vary inflation rates, exchange rates, rents, and any other variable which would significantly affect the analysis. The analyst is required to find the point at which a new value of the variable changes the result of the analysis.

Since each of the three analyses had at least two important assumptions we view to be in error, which do not appear to be the result of explicit written guidance, we believe that OSD guidance needs to be more specific. For sensitivity tests, analysts should be specifically required to vary interest rates and the length of the period of analysis in addition to expected inflation and exchange rates already explicitly required in the guidance. Also, analysts should be required to vary a country's expected inflation and exchange rates so that the relative amount of purchasing power of each country's currency is approximately constant over long periods of time, the principle of Purchasing Power Parity. We believe it is important to know the time range over which results hold; consequently OSD guidance should require that each new assumed value tested



in the sensitivity analysis be tested under a broad range of time periods of analysis.

The requirement that, in the sensitivity analysis, the analysts determine the point at which a variable will change results relieves them of the burden of determining a likely range for the variables but results in at least two other problems. First, this method transfers the responsibility of determining the probable range of future values of the key variables from the analysts to the readers/decisionmakers of the economic analyses, who may have less training and experience than the analysts in making judgments of this type about the future. Second, where there are more than two alternatives, there can be more than one point at which an alternative becomes the least expensive. These additional switching points may not be determined by the analysts, and as a result insufficient information may be provided to the decisionmaker. Suggesting likely ranges of future variables' values for the sensitivity analysis or giving instructions on how to determine these likely ranges for each explicitly listed variable would also improve OSD guidance.

A final problem with OSD guidance on sensitivity analyses is its requirement that rent always be tested. We believe that rent and other variables should be varied in the sensitivity analysis when they add useful information and not varied when they do not. When rent is based on an estimate of the market price (as it was in the Navy study) or on a bid which in turn depends on factors other than expected inflation or exchange rate movements (for example a cost-plus type of bid), then explicitly varying rent adds useful information to the analysis and should be done. However, if rent solely depends on a financially viable fixed-price bid or will vary only due to inflation or exchange rate movements, then we believe that explicitly varying rent does not add enough useful information to warrant doing. Varying rent and other variables always complicates the sensitivity analysis. The risk is that if too many tests are made in the sensitivity analysis, a decisionmaker may be unable to distinguish those that are important from those that are not.

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## Conclusions

We found nine problems in the three economic analyses of foreign housing we reviewed. These nine problems, as a group, were important enough to change major conclusions of each study. All but one of the 16 occurrences of these 9 problems had the effect of making leasing appear more attractive than was in fact warranted.

Our June 28, 1983, report evaluating the long-term leasing of naval ships and aircraft and the Comptroller General's May 19, 1983, letter to the Director of OMB (see pp. 14 and 15) noted that when the present value method is used to evaluate the future costs of the U.S. government, these future costs should be discounted with an interest rate that reflects the U.S. government's cost of borrowing. In the June 1983 report, we recommended that these anticipated U.S. government expenditures be measured in current dollars and discounted with the average interest rate (yield) on outstanding Treasury obligations that mature during the time period of anticipated expense. Each of the three analyses used a very different method from our recommended approach. All used the discounting method based on that prescribed by OMB and one also used an additional method. OMB has drafted a revision to its discounting guidance which appears compatible with the method we recommend. The latest guidance from OSD concerning the economic analyses of foreign housing still requires use of very different methods of discounting from that which we have recommended.<sup>20</sup>

We found eight other types of problems occurring in the three economic analyses.

- Very limited sensitivity analyses.
- No explanation of the special circumstance(s) present for build to lease to be less expensive than military construction.
- Unrealistically high depreciation rate assumed for U.S.-owned buildings and land.
- Use of foreign exchange and inflation expectations far different from those widely accepted by professional economic forecasters.
- No consideration of the financial viability of a recommended alternative.
- Use of an inappropriate method to estimate expected maintenance costs.
- No rationale with supporting evidence given for the assumption that expected utility expenses for military construction were greater than those for build to lease.
- Unrealistic assumption concerning the relationship between the rental and sale prices of land.

All but one of the 16 occurrences of these 9 problems had the effect of making leasing appear to be more attractive than was warranted.

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<sup>20</sup>OMB and Treasury now require DOD to use our recommended discounting method in DOD's economic analyses of the long-term leasing of ships and aircraft.

The recent OSD guidance is not likely to dramatically lessen the future occurrence or severity of the nine types of problems we found. In our opinion, OSD guidance would have lessened the severity of only one problem and eliminated at most one other had it been in effect at the time the three analyses were performed. Consequently, we believe that DOD needs to do much more to bring the quality of these analyses to a level where they will be useful to decisionmakers.

As we demonstrated in our review of these three studies, the quality of economic analyses is very sensitive to the assumptions made and methods used. Although improved OSD guidance can substantially raise the quality of future economic analyses, we recognize that it is unlikely that any set of instructions can foresee all future situations. Thus in order to insure quality economic analyses, the analysts and their reviewers must have adequate training and the time to develop professional judgment.

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## Recommendations

We recommend that the Secretary of Defense require all future economic analyses involving the use of the present value technique to discount (1) only current dollar expenditures and (2) only with the average rate of interest (yield) on Treasury obligations which mature during the period of anticipated expenditures. We understand that OMB is currently revising Circular A-104 to require this type of discounting procedure. Until this revised guidance is effective, we recommend that the Secretary of Defense request a waiver from the current version of Circular A-104 to allow the Department to immediately begin using this recommended discounting technique.

We also recommend that you issue additional guidance on conducting economic analyses of foreign housing that:

- Expands instructions for sensitivity tests.
- Requires full explanation of the special circumstance(s) present when build to lease is found to be less expensive than military construction.
- Gives explicit directions on when and how to calculate political risk considerations in estimates of residual value.
- Requires the use of expected inflation and exchange rates which are representative of those accepted by professional economic forecasters unless there are convincing reasons for not using them. These forecasts could be obtained by averaging the expectations of the three major U.S. econometric forecasting firms.

- Requires that housing alternatives be evaluated for financial viability before being recommended.
- Requires a good rationale with supporting data for assuming maintenance or utility expenses in build to lease significantly different from military construction of approximately the same square footage.
- Gives explicit directions for estimating the rental and sale prices of land.

The instructions for the sensitivity tests in the economic analyses of foreign housing should:

- Explicitly require that the interest rate and the length of the period of analysis be varied along with the expected exchange and inflation rates listed in recent OSD guidance.
- Require that a country's exchange rate and inflation rate be varied together so that they are generally consistent with the principle of Purchasing Power Parity over the period of analysis.
- Set value ranges for the sensitivity tests or give detailed instructions on how to determine these ranges for each explicitly listed variable.
- Require that each new assumed value tested in the sensitivity analysis be tested under a broad, reasonable range of time periods of analysis.
- Require that residual values be varied when they have been lowered due to political risk considerations.
- Distinguish the circumstances under which it is appropriate to vary rents and when it is not.

# OSD Guidance on Consistent Methodology for Overseas Family Housing Leasing Economic Analyses



MANPOWER  
INSTALLATIONS  
AND LOGISTICS

OFFICE OF THE ASSISTANT SECRETARY OF DEFENSE  
WASHINGTON, DC 20301

4 SEP 1984

MEMORANDUM FOR DEPUTY ASSISTANT SECRETARY OF THE ARMY (I&H),  
OASA(IL&FM)  
DEPUTY ASSISTANT SECRETARY OF NAVY (I&F),  
OASN(S&L)  
DEPUTY ASSISTANT SECRETARY OF THE AIR FORCE  
(IE&S), OASAF(MRA&I)

SUBJECT: Consistent Methodology for Overseas Family Housing  
Leasing Economic Analyses

In response to a request by the HAC MILCON subcommittee for more consistency among Service economic analyses prepared in support of family housing lease proposals, we have held meetings with a working group of the housing steering committee to determine what factors could be standardized. Emphasis was placed on analysis assumptions and format. It was determined that the general procedures used by each Service have been similar but that by using divergent selection and application of factors such as inflation, rent escalation, exchange rates and economic life, the resulting products gave the appearance of dissimilar methodologies. Because the general procedures used by the Services are similar, agreement on a standardized set of assumptions was achieved without altering, to any major extent, the procedures for producing an economic analysis.

The three attachments to this memorandum provide guidance on standardized assumptions and format for economic analysis presentation.

The incorporation of these standards by your instructions to the field will go a long way toward producing uniform economic analyses in support of overseas family housing leasing. That uniformity will improve the credibility of our program.

Robert A. Stone  
Deputy Assistant Secretary of Defense  
(Installations)

Enclosures 3

Excellent Installations – The Foundation Of Defense

FAMILY HOUSING STANDARDS

The following standards will be used in the generation of family housing leasing economic analyses:

Discount Rate - The 10 percent discount rate, as recommended in DoD Instruction .041.3, will be used. The discount rate, used to bring all costs to present value, should not be modified.

Residual Value - Where residual value is a factor such as in new construction or a lease buy out, the Building Decay Obsolescence Factors in Attachment B to OMB Circular No. A-104 will be used to determine the value at any point in time.

Inflation - Host nation inflation will be accommodated in the current dollar matrix. Where payment is in US dollars, the host nation inflation rate must be modified by the affect of the dollar/local currency exchange rate.

Rent Escalation

- Constant dollar matrix. Estimates for lease renewal will escalate previous term lease costs by the OSD/OMB overseas inflation indices.
- Current dollar matrix. Estimates for lease renewal will escalate at a rate that best approximates the lease cost at the specific location within the host country.

Exchange Rate - The rate used will be the budget rate in effect at the time the economic analysis is produced and will be constant through the analysis. Changes to the rates will be tested in the sensitivity analysis.

Economic Life - Will, for the purpose of the analysis, be considered to be 25 years unless a lesser period of use is expected.

Cost Basis

- Leasing. Must reflect actual proposal costs or that for comparable units in the local economy. A maximum allowable lease cost will not be assumed.
- Construction. New construction estimates will be made by modifying the tri-service family housing cost model to reflect U.S. built housing shipped to the project site.

Attachment #1

Appendix II  
OSD Guidance on Consistent Methodology for  
Overseas Family Housing Leasing  
Economic Analyses

2

Format - The economic analysis must display the full 25 year cost matrix (or for the period of use when less than 25 years). Years will run vertically and cost will be displayed across the page. Two basic analysis matrices should be run. The first with constant dollars (no inflation). Constant dollar cost streams will start with the purchasing power of the dollar at the time of decision and will reflect only real changes in cost due to changes in amounts of service. The second with current (inflated) dollars will be based on the published OSD/OMB overseas inflation rates. Where unique circumstances exist that would strongly affect the analysis, (such as inflation for a cost deviating from the published rates) a modified matrix may be displayed. In all cases, full explanation will be provided in the narrative portion of the analysis.

Sensitivity Analysis - Key variables to be tested will include changes in inflation rates, exchange rates and rent. Any other variable which would significantly impact the analysis should also be tested. Display the sensitivity analysis in an abbreviated form. The variable value at the point of change and the resulting present value only need to be shown.

Appendix II  
OSD Guidance on Consistent Methodology for  
Overseas Family Housing Leasing  
Economic Analyses

SENSITIVITY ANALYSIS RESULTS

Variable Tested \_\_\_\_\_

Variable value at point where results are changed \_\_\_\_\_

Cumulative Discounted Value of alternatives when variable alters  
results:

Alternative 1 \_\_\_\_\_

Alternative 2 \_\_\_\_\_

etc.



Appendix II  
OSD Guidance on Consistent Methodology for  
Overseas Family Housing Leasing  
Economic Analyses

ANALYSIS DISPLAY FORMAT

PROJECT YEAR	(recurring and non-recurring costs)					TOTAL	10% DISC FACTOR	PRESENT VALUE	CUMULATIVE DISC VALUE
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
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20									
21									
22									
23									
24									
25									
TOTALS									

# Comments From the Assistant Secretary of Defense (Acquisition and Logistics)

Notes: GAO comments supplementing those in the report text appear at the end of this appendix



ACQUISITION AND  
LOGISTICS

ASSISTANT SECRETARY OF DEFENSE

WASHINGTON, D.C. 20301-8000

3 MAR 1986

Mr. Frank C. Conahan  
Director, National Security  
and International Affairs Division  
U.S. General Accounting Office  
Washington, D.C. 20548

Dear Mr. Conahan:

This is the Department of Defense (DoD) response to the General Accounting Office (GAO) Draft Report, "Military Housing: Analyses Of Overseas Housing Costs Are Misleading To Decisionmakers," dated December 3, 1985 (GAO Code 945521), OSD Case 6740-A.

The DoD partially concurs with the draft report, which is based on the evaluation of three relatively old economic analyses. All three analyses, as the GAO points out, were made prior to the latest DoD guidance. This guidance substantially increased the scrutiny over, and the quality of, the later economic analyses of this type. Furthermore, as recognized by the GAO, the Army and Air Force analyses did not lead to inappropriate decisions. The Navy analysis was performed in accordance with DoD guidance and did not include errors of assumption.

The DoD disagrees with certain GAO assumptions used in the draft report. There is no reason to assume that military construction (MILCON) housing will be cheaper than build-to-lease. The circumstances that prevail at the time a project is planned determine which approach is proper and most economical, and current economic analyses will show this. In addition, the DoD disagrees with the GAO conclusion that the proposal for the Air Force project in Spain was too good to be true and should have been questioned on that basis. When a reputable bidder that has performed successfully on other projects provides a low bid, there is no basis to assume that the bid is not economically viable for the bidder.

It also is important to point out that the primary reason the GAO-generated results differ from those in the reviewed analyses was the use of a different discount rate. For the GAO to characterize the DoD economic analyses as poor when the different answers resulted primarily from the use of different

See comment 1

See comment 2

See comment 3

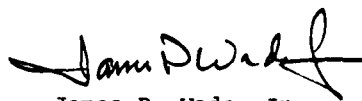
Appendix III  
Comments From the Assistant Secretary of  
Defense (Acquisition and Logistics)

2

discount rates was inappropriate. The DoD used the rate required by Office of Management and Budget (OMB) guidance. The OMB apparently is in the process of revising guidance to include use of a discount rate similar to the one recommended by the GAO, but in the interim, the DOD is required to use the current OMB guidance rate.

Detailed comments on the GAO findings are enclosed. The Department appreciates the opportunity to comment on the report.

Sincerely,

A handwritten signature in dark ink, appearing to read "James P. Wade, Jr.", with a stylized flourish at the end.

James P. Wade, Jr.

GAO DRAFT REPORT - DECEMBER 3, 1985  
(GAO CODE 945521) - OSD CASE 6740-A

**"MILITARY HOUSING: ANALYSES OF OVERSEAS HOUSING COSTS  
ARE MISLEADING TO DECISIONMAKERS"**

**DOD COMMENTS**

\* \* \* \* \*

**FINDINGS**

- o **FINDING A: Economic Analyses For Overseas Family Housing Are Poor.** Noting Committee on Appropriations concern about the reliability of the Services' economic analyses of overseas family housing, GAO reviewed one analysis by each Service issued between December 1982 and January 1984. GAO identified nine types of problems (listed on p. 5, Appendix I, GAO Draft Report) occurring 16 times in the three analyses. GAO found that all but one of the 16 occurrences of these problems had the effect of making leasing appear to be more attractive than was warranted. As a result of these problems, GAO concluded that all three economic analyses were poor and were misleading to decisionmakers, as follows:

- The Navy study concluded that straight leasing was the least expensive alternative. In GAO's base case and in 11 of the 12 cases in its sensitivity analysis, GAO found lease with purchase to be the least expensive alternative.

- The Army study concluded that using housing manufactured in the United States and erected in West Germany would cost more than leasing, but the study recommended this type of housing because it was considered the only feasible alternative. GAO found U.S.-Manufactured housing to be less expensive than build to lease in its base case and 6 of 8 cases in its sensitivity analysis.

- The Air Force study recommended a build to lease alternative that appeared to be "too good to be true;" either the rent would not cover the mortgage payment in the recommended alternative or the lessor had to be able to build housing at much less cost than the Air Force estimated for the military construction alternative.

(pp. 1, 2 Letter, pp. 5-6 Appendix I, GAO Draft Report)

ENCLOSURE

Now on p. 12.

Now on pp. 1,2, 12-13

See comment 9 & 3.

- o **DoD Position:** Partially concur. The three analyses reviewed in the report were completed prior to the Office of the Secretary of Defense (OSD) uniform guidance for such analyses. Analysis of the GAO alterations shows that in almost all cases, the decisions were tipped because of the discounting procedures used. The analyses do contain flaws, but should not be characterized as poor simply because a discount rate different from the one advocated by the GAO produced results different from the GAO results. The DoD applied the discount rate stipulated in the governing OMB guidance (see Finding B).
- o **FINDING B: Inappropriate Interest Rate Used In Discounting.** GAO found that all three economic analyses discounted constant dollar expenditures with a real interest rate of 10 percent. GAO pointed out that its policy is to discount current dollar expenditures using the average rate (yield) on Treasury obligations maturing during the period of anticipated expenditures. GAO also pointed out that in a May 19, 1983 Comptroller General letter to the Director, Office of Management and Budget (OMB) this policy was explained and appropriate changes to the OMB Circulars A-94 and A-104 were suggested. To date, GAO noted, OMB has not revised these circulars; consequently, the Services are required to discount as they did in these analyses. In contrast, however, GAO noted that OMB and Treasury, as GAO recommended, have mandated that DoD discount current dollar expenditures with market rates charged the Treasury (plus 1/8 percent) when considering long-term leasing for aircraft or ships. GAO noted an equivalent discounting method to that suggested in its May 19, 1983 letter is to adjust both the expected expenditures and the interest rate over the period of analysis and then discount; that is, constant dollar expected expenditures are discounted by the real (after expected inflation) interest rate that the Treasury is charged by the financial market. GAO concluded the effect of discounting at a real rate of 10 percent (considered by GAO to be too high) versus a 5.3 percent real rate is to lower the downstream cost effects. This procedure, GAO concluded, would overestimate the attractiveness of lease alternatives when compared to construction, as was the case with all three economic analyses reviewed. (pp. 8-10, 21, 38 Appendix I, GAO Draft Report)
- o **DoD Position:** Partially concur. OMB Circular A-104, with which DoD is required to comply, has precluded the use of the interest rate on Treasury borrowing as the discount rate for the economic analyses reviewed by the GAO. DoD notes

Now on pp. 14-15, 21, 24-25, 31.

See comment 4

however, that OMB is in the process of revising Circular A-104. The revision, as currently drafted, requires discounting of current dollars at a rate equal to the interest rate on Treasury borrowing, which is the same general approach favored by GAO. The DoD will continue to apply whatever discount rate that the OMB stipulates in accordance with the requirements.

- o **FINDING C: Navy Used Incorrect Discount Rate.** GAO found that the Navy discounted cash flows using a 10 percent discount rate as required by DoD and OMB guidance. GAO concluded that cash flows should have been discounted with a real interest rate of about 5.3 percent (see Finding B for GAO's arguments on discounting). GAO, therefore, concluded that the Navy study overestimated the attractiveness of straight leasing by discounting with too high an interest rate. (pp. 8-10, Appendix I, GAO Draft Report)

**DoD Position:** Nonconcur. See DoD response to Finding B.

- o **FINDING D: Navy Assumed Too Low Inflation For Italy.** GAO found that Navy assumed the inflation rate of Italian goods would be 5.5 percent lower than the inflation rate on U.S. goods, with prices measured in dollars. GAO pointed out that major econometric forecasting firms and the principle of Purchasing Power Parity expect that the relative purchasing power of one currency compared to another will be maintained over time, i.e., the average inflation of Italian goods approximates that on American goods during a period as long as the study's period of analysis. GAO concluded, therefore, that Navy overestimated the attractiveness of straight leasing because expected Italian inflation should have been relatively higher, having a greater effect on downstream costs. (pp. 10-12, Appendix I, GAO Draft Report)

**DoD Position:** Nonconcur. The analysis is site specific and should use the inflation expectation for that area, as provided by the Navy's real estate organization. This approach provides a much more precise figure for the site than using a general formula applicable to a country or large region.

- o **FINDING E: Navy Assumed Incorrect Terminal Value.** GAO found that Navy assumed the real value of land and structures owned by the United States in Italy would be zero at the end of the 30-year period of analysis. GAO pointed out that by assuming the structures and land had no terminal value, the Navy assumed 100 percent depreciation over the period of analysis. GAO found that Navy had no realistic

Now on pp. 14-15.

See comment 4.

Now on pp. 15-16.

See comment 5.

basis for assuming the land and buildings could not be sold at the end of the analysis period. GAO concluded that, without such a basis, 100 percent depreciation over 30 years violates OSD guidance. (pp. 12-14, Appendix I, GAO Draft Report).

**DoD Position:** Concur. This situation, however, is not clear cut. In Italy, the only option that would result in any real residual value would be the lease-with-purchase option. In all other cases, the property ownership would reside with the Italian Government. The only residual value would be the possible continued U.S. use of the property at no rental cost. The U.S. could not sell the property at the end of the analysis period. The Navy will, nonetheless, follow OSD guidance for residual value in the future.

- o **FINDING F: Navy Assumed Incorrect Land Rent.** GAO found that Navy assumed annual land rent would be 15 percent of the land's market price. GAO pointed out that a leading theory of investment implies that the annual rental price of land divided by its sale price equals the real interest rate. According to GAO, estimates by three major U.S. econometric firms averaged 5.3 percent, significantly lower than the Navy's figure of 15 percent. GAO concluded that the Navy assumption overstates the attractiveness of both the straight lease and the lease-construct alternatives. (pp. 14-15, Appendix I, GAO Draft Report)

**DoD Position:** Nonconcur. The Navy figure for annual land rent is based on historical data. This is a much more accurate figure than using a general theory of investment. Where relevant actual data is available, it should always be used instead of turning to a generalization.

- o **FINDING G: Navy's Sensitivity Analysis Inadequate.** GAO found that the Navy's sensitivity analysis treated only two different periods of analysis. GAO concluded that this was inadequate. (pp. 14-16, Appendix I, GAO Draft Report)

**DoD Position:** Concur. The Navy analysis was completed prior to the issuance of new OSD guidance and did not test all variables that would significantly affect the analysis. Future analyses will do so.

- o **FINDING H: Army Analysis Is Unnecessary, As Well As Poor.** GAO noted that the Army's Bad Kreuznach study was unnecessary. Since MILCON was the only feasible alternative, GAO pointed out, there was no need for Army to perform a present value analysis. GAO reported, however, that Army did perform analyses and concluded economy housing

was least expensive and construction was most expensive. GAO agreed with Army that economy housing was the least expensive, but found build-to-lease to be slightly more expensive than construction. GAO concluded that the Army, as with the Navy, overestimated the attractiveness of the build-to-lease alternative due to the method of discounting. (pp. 19-21, Appendix I, GAO Draft Report)

Now on pp. 20-21.

**DoD Position:** Partially Concur. The Department agrees that Army performed an unnecessary economic analysis; however, the DoD disagrees that the analysis overestimates the attractiveness of build-to-lease because of the discount rate. (See also the DoD response to Finding B).

See comment 4.

- o **FINDING I: Army Assumed Maintenance And Repair Costs For Construction (New Units) Would Be Different For Build-To-Lease (Also New Units).** GAO found that the maintenance and repair schedule for construction was calculated from 30-year old on-post housing units, and the one for leasing was calculated from 10-year old build-to-lease units. Noting that housing of different ages was used for the different alternatives, GAO concluded the Army claim that maintenance and repair costs for constructed housing was more than build-to-lease was not justified and it was reasonable to expect the costs to be the same. (pp. 24-25, Appendix I, GAO Draft Report)

Now on p. 23.

**DOD Position:** Concur. The Army economic analysis was completed prior to the issuance of new OSD and Army guidance. The errors in the analysis have not been repeated in subsequent analyses. It should be noted, however, that there will be cases where costs will differ for different options that appear to be essentially the same. In such a case, explanation will be provided in the narrative portion of the analysis.

- o **FINDING J: Army Utility Cost Estimates Unreasonable.** GAO found that Army assumed the costs for the same utilities for the same square footage of housing would be 19 percent greater for construction than for build-to-lease. GAO also found that the Army had no rationale for the utility costs being different. GAO concluded, therefore, that the utility costs should be assumed to be the same for both alternatives. (p. 25, Appendix I, GAO Draft Report)

Now on p. 23.

**DoD Position:** Concur. See the response to Finding I, which concerns the same situation.



- o **FINDING K: Army's Implicit Expectation Of High Additional Inflation For German Residential Construction Unreasonable.** GAO found that Army assumed German residential construction appreciates in price approximately 3 percent faster than German goods and services in general, causing the cost of the build-to-lease alternative to rise in relation to construction. GAO also found that between 1970 and 1982, the average inflation for construction was less than 1 percent higher than for goods and services in Germany. GAO noted that U.S. econometric forecasting firms estimated an average growth for German residential construction of .99 percent a year from 1984 to 2000. GAO concluded that the Army's implicit expectation of high additional inflation for German residential construction was unreasonable. (pp. 20-24, Appendix I, GAO Draft Report)

Now on pp 20-22

**DoD Position:** Nonconcur. The analysis is site specific and should use the inflation expectation for that area, as provided by the Army's real estate organization. All of the Services can obtain a much more precise site specific figure for this factor than a generalized formula that is applicable only to a country or large region.

See comment 7

- o **FINDING L: Army's Sensitivity Analysis Limited.** GAO found Army varied only two of the six variables GAO varied. GAO concluded that Army's sensitivity analysis was very limited. (p. 25, Appendix I, GAO Draft Report)

Now on p 23

**DoD Position:** Concur. (See also DoD response to Finding G)

- o **FINDING M: Air Force Analysis Is Poor.** GAO noted that the Air Force's Torrejon study considered three alternatives using two discounting methods--one discounted constant dollar costs with a real interest rate of 10 percent (as Army and Navy), and the other discounted current dollar costs with an interest rate approximately 1.3 percent less than the financial markets were charging--and concluded the build-to-lease alternative was most economical. GAO found, however, that the rent assumed for the build-to-lease alternative would not be sufficient to pay the mortgage on the estimated building costs of the construction alternative. GAO concluded, therefore, that either (1) the construction cost in the build-to-lease alternative was substantially less than estimated for the construction alternative, or (2) the build-to-lease alternative was not financially viable. GAO further concluded that, because Air Force failed to address the financial viability of build-to-lease, the analysis was biased toward choosing this

alternative. GAO also found that Air Force did not calculate a residual value for the lease or construction alternatives and gave no excuse for ignoring the residual values in its procedures. GAO additionally found that only the interest rates were varied in the sensitivity analysis. GAO was unable to redo the Air Force analysis, because it was unable to obtain information on a viable substitute build-to-lease bid, but pointed out that (1) two weeks after the study was completed the Air Force signed a build-to-lease contract, (2) six months later, the lessor had not obtained financing and the lease was amended, with the U.S. Government obligated to higher rental payments, (3) in October 1984, the Air Force terminated the lease agreement, because the lessor still had not obtained the necessary financing, and (4) the Air Force currently plans to solicit new bids for this project. (pp. 28-31, Appendix I, GAO Draft Report)

Now on pp. 24-26.

**DoD Position:** Partially concur. The DoD does not concur with the GAO conclusion that either the build-to-lease construction cost was less than the MILCON construction cost, or the build-to-lease was not viable. Build-to-lease construction costs that were less than MILCON construction costs may well have been the case, but the bidder is not required to divulge his costs. This proposal was submitted by a reputable, responsible entrepreneur who has successful contracts with the Air Force for similar projects in a number of other locations. After extensive negotiations with the Air Force, the entrepreneur willingly signed a contract for the project, which indicated that he considered the project to be economically viable even though the rent cost might appear to be unrealistically low. The inability of the entrepreneur to obtain financing is attributable more to subsequent changes in tax laws and to political uncertainty than to the amount of rent proposed. Once again, the analysis was accomplished prior to the issuance of OSD guidance and did not include a residual value for the facility. A residual value will be used in future analyses. In addition, future sensitivity analyses will test all variables that would significantly affect the analyses.

See comment 8

- o **FINDING N: OSD Guidance Is Inadequate - Only One Of Eight Types Of Errors Found Could Have Been Eliminated.** GAO noted that in June 1984, the House Committee on Appropriations directed the Office of the Secretary of Defense to develop and implement a methodology based on realistic assumptions for use in economic analyses of foreign housing lease agreements. GAO also noted that the Deputy Assistant

Secretary of Defense for Installations issued such guidance in September 1984. GAO found that the guidance would have lessened the severity of only one of the eight types of errors found in the three studies and would have eliminated, at best, only one other had it been in effect when these analyses were performed. GAO found the OSD guidance requires the use of a 1.7 percent a year declining-balance depreciation rate on buildings, and a 1.5 percent a year real appreciation rate on land. GAO concluded that this guidance could have eliminated the problems of the high depreciation rates in the Navy and Air Force studies. (pp. 31-32, Appendix I, GAO Draft Report)

Now on p. 27.

**DoD Position:** Partially Concur. Although the DoD agrees that the new guidance will eliminate only one of the perceived errors, the DoD does not agree that all the perceived errors are errors in fact. See DoD responses to Findings O through R.

See comment 9.

- o **FINDING O: DoD Guidance Is Inadequate - Political Risk.** GAO found that the OSD guidance does not explain when or how to account for political risk in calculating terminal values and is, therefore, incomplete. GAO concluded that while precise measurements of political risk may not be available, OSD should explicitly instruct the Services on when and how to incorporate it into analyses, and should require that when residual value is lowered by political risk, it be varied in the sensitivity analysis. (pp. 32-33, Appendix I, GAO Draft Report)

Now on pp. 27-28.

**DoD Position.** Concur. An updated DoD Instruction for economic analyses that will follow the issuance of the revised OMB Circular A-104 will cover this subject.

- o **FINDING P: DoD Guidance Is Incomplete - Discount Rate.** GAO found that the OSD guidance would not have eliminated the problem of discounting with an inappropriate interest rate, since the guidance did not require the use of the market rate of interest. (p. 34, Appendix I, GAO Draft Report)

Now on p. 28.

See comment 4.

**DoD Position.** Nonconcur. See DoD response to Finding B.

- o **FINDING Q: DoD Guidance Is Incomplete - Exchange Rates.** GAO found that the OSD guidance will not reduce the occurrence or severity of poor inflation or exchange rate expectations in future analyses because, (1) it requires analysts to, unrealistically, assume the exchange rate will remain constant, (2) it is too general, giving no instruction on which inflation indices to use when

Now on pp. 28-29.

calculating expenditures other than rent, and (3) it is confusing on inflation expectations, requiring the use of domestic not foreign price escalation series, which in these circumstances is inappropriate. (pp. 34-35, Appendix I, GAO Draft Report)

See comment 10.

**DoD Position.** Nonconcur. The forecasts of exchange and inflation rates are, at best, guesses. It is better to set a rate and then test the sensitivity of that rate. A judgement can then be made on the possibility of the rate reaching the point where the analysis results would be changed. Setting specific rates is not necessary if this process is followed. In addition, inflation series are generic and apply to the rate rather than the location. Accordingly, such a series can be applied to either domestic or foreign rates appropriately.

- o **FINDING R: DoD Guidance Is Incomplete - Sensitivity Analysis.** GAO noted that the OSD guidance would be a large step forward in improving sensitivity tests, were analysts sufficiently skilled. Since each of the three analyses had at least two important assumptions in error, which did not appear to be the result of explicit written guidance, GAO concluded that not enough analysts have the necessary level of skills. GAO further concluded, therefore, that OSD guidance needs to be more specific, and analysts should be required to: (1) vary interest rates and the analysis period, in addition to the already required inflation and exchange rates; and (2) vary a country's expected inflation and exchange rates together, using the Principle of Purchasing Power Parity. GAO also concluded that the guidance should suggest value ranges for sensitivity analyses or give instructions on how to determine these ranges, and require each variable to be tested over a broad range of time periods. GAO further concluded that rent should be tested only when doing so adds information to the analysis (when rent is an estimate or is otherwise variable). Finally, GAO concluded that while improved guidance can improve the quality of economic analyses, no set of instructions can sufficiently substitute for analysts having adequate training or the time to develop professional judgement. (pp. 35-37, 40 Appendix I, GAO Draft Report)

Now on pp. 29-30, 32.

See comment 11.

**DoD Position.** Partially concur. The current guidance requires the analyst to vary all variables that could change the analysis. This will accomplish the proper results. The current guidance also requires the sensitivity test to be carried to the point where the results of the analysis would be changed. That is sufficiently broad. The inclusion of

rent in the sensitivity analysis gives the analyst the point at which the rent would make build-to-lease or straight lease uneconomical and is done so only to add information to the analysis. That is important in those cases where the analysis is accomplished prior to acceptance of proposals. (See also, the response to Recommendation 2)

**RECOMMENDATIONS**

- o **RECOMMENDATION 1:** GAO recommended that the Secretary of Defense ask the Office of Management and Budget for a waiver from Circulars A-94 and A-104 to enable the Office of the Secretary of Defense (OSD) to issue additional guidance on discounting requiring all economic analyses performed by and or for the DoD, which use the present value technique to determine the least costly alternative, to discount (1) only current dollar expenditures and (2) only with the average rate of interest (yield) on outstanding Treasury obligations which mature during the period of anticipated expenditures. (p. 40 Appendix I, GAO Draft Report)

Now on p 32.

**DoD Position:** Nonconcur. As noted above (response to Finding B), the OMB has drafted a revised Circular A-104, which specifies the type of discount rate sought by GAO. The waiver recommended by GAO probably could not be reviewed and granted in appreciably less time than it will take to review and issue the revised Circular. Moreover, the recommended waiver, since it would apply only to DoD, would increase rather than reduce the fragmentation and inconsistency of federal policy on discount rates. DoD, therefore, favors concentrating the available resources on finalizing and issuing the revised government-wide policy.

See comment 12

Circular A-94, also mentioned by GAO, prescribes the discount rate for global cost-benefit analyses. It explicitly does not apply to lease-versus-buy analyses of real property, and is therefore not relevant to the economic analyses reviewed by the GAO.

See comment 13

- o **RECOMMENDATION 2:** GAO recommended the Secretary of Defense issue additional guidance on the economic analysis of foreign housing that expands instructions for sensitivity tests to:

- explicitly require that the interest rate and the length of the period of analysis be varied along with the expected exchange and inflation rates listed in recent OSD guidance;

- require that a country's exchange rate and inflation rate be varied together so they are generally consistent with the principle of Purchasing Power Parity over the period of analysis;

- set value ranges for the sensitivity tests or give detailed instructions on how to determine these ranges for each explicitly listed variable;

- require that each new assumed value tested in the sensitivity analysis be tested under a broad, reasonable range of time periods of analysis;

- require that residual values be varied when they have been lowered due to political risk considerations; and

- distinguish the circumstances under which it is appropriate to vary rents and when it is not.

(p. 41-42, Appendix I, GAO Draft Report)

**DoD Position:** Partially concur. The updated DoD Instruction for economic analysis that will follow the issuance of the revised OMB Circular A-104 will provide the appropriate guidance on political risk considerations (item 5). The DoD does not agree that exchange rates and inflation rates should be based on the Principle of Purchasing Power Parity (item 2), or that further guidance is required for the remaining items. (See also the DoD responses to Findings N through R.)

- o **RECOMMENDATION 3:** GAO recommended the Secretary of Defense issue additional guidance on the economic analysis of foreign housing that requires full explanation of the special circumstance(s) present when build-to-lease is found to be less expensive than military construction. (p. 41, Appendix I, GAO Draft Report)

**DoD Position:** Nonconcur. There is no reason to assume that build-to-lease should be more expensive than MILCON. The circumstances under which the entrepreneur makes up his proposal dictates the bid price. The prices may be higher or lower than MILCON. The existence of tax incentives could mask higher construction costs but, as the bidder does not divulge his costs, this is never known.

- o **RECOMMENDATION 4:** GAO recommended the Secretary of Defense issue additional guidance on the economic analysis of

Now on pp. 32-33.

See comment 14.

Now on p. 32

See comment 15.

Now on p 32

foreign housing that gives explicit directions on when and how to calculate political risk considerations in estimates of residual value. (p. 41, Appendix I, GAO Draft Report)

**DoD Position:** Concur. The update of the DoD Instruction for Economic Analysis which will follow the issuance of the new OMB Circular A-104 will cover this subject.

Now on p 32

- o **RECOMMENDATION 5:** GAO recommended the Secretary of Defense issue additional guidance on the economic analysis of foreign housing that requires the use of expected inflation and exchange rates, which are representative of those accepted by professional economic forecasters. These forecasts could be obtained by averaging the expectations of the three major U.S. econometric forecasting firms. (p. 41, Appendix I, GAO Draft Report)

See comments 10 & 16.

**DoD Position:** Nonconcur. While it may be possible to forecast changes in exchange rates in the short term, the DoD knows of no source of reliable forecasts of exchange rates over the length of time involved in long term leases of overseas housing. Since there is no basis for concluding that exchange rates twenty years hence will be either more or less favorable than they are now, DoD uses the current exchange rate throughout the analysis. This approach has the virtue of administrative simplicity, and sensitivity analyses can point out the thresholds where alternatives "flip-flop."

Now on p 33

- o **RECOMMENDATION 6:** GAO recommended the Secretary of Defense issue additional guidance on the economic analysis of foreign housing that requires that housing alternatives be evaluated for financial viability before being recommended. (p. 41, Appendix I, GAO Draft Report)

See comment 17

**DoD Position:** Nonconcur. When a responsible and reliable bidder provides a bid that is more advantageous than MILCON, there is no basis for assuming the bid is not legitimate. When a low bid is submitted by a bidder of unknown credentials, however, it is scrutinized to insure that the bidder can produce at the proposed price.

Now on p 33

- o **RECOMMENDATION 7:** GAO recommended the Secretary of Defense issue additional guidance on the economic analysis of foreign housing that requires a good rationale with supporting data for assuming maintenance or utility expenses in build-to-lease that are significantly different from military construction of approximately the same square footage. (p. 41, Appendix I, GAO Draft Report)

13

**DoD Position:** Concur. The only case where this has happened is in the Army analysis reviewed by GAO and that problem has already been overcome by Army guidance.

- o **RECOMMENDATION 8:** GAO recommended the Secretary of Defense issue additional guidance on the economic analysis of foreign housing that gives explicit directions for estimating the rental price of land and its sales price. (p. 41, Appendix I, GAO Draft Report)

**DoD Position:** Nonconcur. The current practice of relying on historical actual real estate data gathered by the Services' real estate organizations ensures much more reliable data than using a generalized formula.

Now on p. 33.

See comment 18.



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The following are GAO's comments on the Assistant Secretary of Defense (Acquisition and Logistics) letter dated March 3, 1986.

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## GAO Comments

1. We believe that the three analyses we reviewed are representative of present economic analyses of overseas family housing by the military services. As we stated in the draft, each of the evaluated studies was the most recent available European economic analysis of a service (with one minor exception) at the time we began our evaluation. Our review of the more recent OSD guidance to the services found that at best it would have eliminated only one of the nine types of problems we found in the three economic analyses and lessened the severity of only one other. Consequently we do not believe that the OSD guidance in and of itself substantially improved the quality of the economic analyses. Regarding DOD's statements about each of these analyses:

The Air Force study may have caused two undesirable results. Six months after the signing of the lease agreement for the build to lease alternative, the Air Force agreed to an increase in rental payments. Twenty-two months after the lease signing, the Air Force terminated the lease agreement because financing still could not be obtained. As we stated in the draft, the principal problem with the Air Force study was that it did not investigate the financial viability of the build to lease alternative despite evidence then present that indicated an investigation was warranted.

The Army study's present value analysis did not contribute to an inappropriate decision because with only one financially viable alternative, there was no economic decision to be made and no reason to perform the present value analysis. Our evaluation indicates that the Army study's present value analysis overestimated the expense of the construction alternative, relative to the build to lease alternative, although it correctly indicated that economy housing was the least expensive.

Our evaluation found six types of problems occurring in the Navy study, all of which we still believe to be problems. Four of these are errors of assumption; DOD's position is that three of these are not errors. See DOD positions and our comments on DOD positions C, D, and F.

2. We do not assume that military construction was necessarily less expensive than build to lease. As we reasoned in the draft report, in most cases the desire of a lessor to obtain profits from leasing activities and the necessity of borrowing at interest rates higher than those

charged the U.S. government will usually cause leasing to be more expensive to the U.S. government than military construction. However, we do recognize that special circumstances, five of which were listed in the draft, can reduce a lessor's cost sufficiently to cause build to lease to be less expensive. Consequently, any economic analysis that finds leasing to be the least expensive alternative should fully explain special circumstance(s) present so that others can assess the validity of its results. In the Air Force study, we found that the rent for the build to lease alternative was much less than was necessary to finance construction costs equal to those estimated by the study for the military construction cost alternative. The study did not give a special circumstance explaining this anomaly.

3. Our characterization of the quality of these analyses was based on the large variety of problems they contained, the high frequency of problem occurrence, and the effects of these problems on the major conclusions of the studies. There were eight types of problems in addition to the inappropriate discount rate. Even had all of these nine types of problems been caused by directives originating outside of DOD, our characterization of the quality of these analyses would not have been changed. DOD admits its analyses contain flaws.

4. Three years ago, we suggested that OMB and DOD adopt the government's cost of borrowing as the appropriate rate of discount for determining the least costly alternative. We are pleased that OMB may soon require this method. The draft revision of OMB Circular A-104 suggests that the discounting procedure used in these studies is inappropriate.

5. As we pointed out in our draft report, all price forecasts used in the Navy study differed greatly from those of the three major econometric forecasting firms. Compared with the average forecasts of these firms, the Navy study forecast 3.7 percent per year higher U.S. inflation, 4.6 percent per year higher Italian inflation than on Italian goods and services in general, and 6.45 percent per year faster depreciation of the Lira. We believe that the inflation rate of buildings should not be expected to deviate very much from the inflation rate of goods and services in general on average over a period as long as 30 years unless there is strong evidence to the contrary. Since neither DOD nor the Navy study have documented the method used, we are unable to confirm that expectations were found from analysis of site-specific historical data. Lack of documentation also prevents us from determining if the analysis would have convinced a professional forecaster to prefer the Navy

study's forecast over those of the three largest U.S. econometric forecasting firms.

6. The Navy study did not explain why renting land in Sigonella should have been expected to yield a 15-percent per year real rate of return over the 30-year period. Our draft report presented evidence that a much lower rate of return should have been expected. DOD states, without providing any documentation, that this 15-percent per year real rate of return was obtained by the Navy study from its analysis of site-specific historical data. Without documentation, we are unable to determine if the analysis was performed in this manner and, if done, whether the analysis would have convinced a professional forecaster to expect a much higher rate of return from renting land in Sigonella than from other investments.

7. The Army study provided no supporting evidence for its assumption of 3 percent per year higher inflation in construction than in German goods and services in general. DOD states, without providing any documentation, that the Army study obtained this figure by a site-specific data analysis. Without documentation, we are unable to determine if the analysis was performed and, if done, whether the analysis would have convinced a professional forecaster that 3 percent per year greater construction inflation should have been expected throughout the 25-year period of analysis at that site. As our draft report points out, in contrast, the three major U.S. econometric forecasting firms expected on the average only 1 percent per year additional construction inflation for Germany approximately equal to that of the prior 19 years.

8. Simply because an entrepreneur has bid on a project does not imply that the project should have been expected to be financially viable. The entrepreneur may have deliberately underbid, believing that additional money would be forthcoming if the financial need arose, or he may have made a serious miscalculation due to overly optimistic expectations about the future compared to that which was, at the time, reasonable. An entrepreneur's record of prior success is a reasonable criterion for believing that a bid slightly less than the market appears to be charging is indeed financially viable. However, for the Torrejon project, the build to lease bid was substantially less than the Air Force study's cost estimate of the military construction alternative. DOD states the principal causes of the subsequent inability to obtain financing but does not provide documentation.

9. We continue to believe that the recent OSD guidance will eliminate only one of the nine problems we discovered in the analyses and lessen the severity of only one other. DOD states that two of the seven problems we believe OSD guidance will not improve are not problems and that for one other OSD guidance is adequate. (See comments 4, 10, and 11.)

10. Inflation and exchange rate forecasts need not be simply guesses. More accurate methods are available. Predictions made by the leading U.S. econometric forecasting firms are not guesses, although they have a degree of imprecision to them; their inflation forecasts have been shown to be more accurate on the average than those formed by simpler forecasting methods, such as assuming that one year's level of inflation will always equal that of the next year or that future inflation will always equal zero. As we mentioned in our draft, many professional economists believe that over long periods of time, such as a 25-year period of analysis, the exchange rate between two countries tends to adjust, so the average inflation rate on a foreign country's goods approximates that on American goods if the prices of both goods are measured in dollars. This is known as the relative version of Purchasing Power Parity. As mentioned in the draft, the three largest U.S. econometric forecasting firms expected Italian lira inflation to exceed U.S. dollar inflation at the time of the Navy study. Not surprisingly, these professionals did not assume the lira/dollar exchange rate to be constant, as the current OSD guidance would have instructed, but, in their long term forecasts, expected it to vary in accordance with Purchasing Power Parity.

We have never previously heard inflation rates described as generic. The U.S. inflation rate measures the growth rate of prices in terms of U.S. dollars. A foreign inflation rate measures the growth rate of prices in terms of the local foreign currency. Therefore the domestic and foreign inflation rates are not interchangeable.

11. As we stated in our draft, since we found a large number of problems in these studies that do not appear to be the result of explicit written instructions, we believe the OSD guidance on conducting sensitivity tests needs to be more specific. It should require that interest rates and the length of the period of analysis be varied in addition to the inflation and exchange rate expectations already required by current OSD guidance. Also inflation and exchange rates should be required to be varied together in a manner consistent with Purchasing Power Parity. In addition, it should (1) set value ranges for the sensitivity tests or give detailed instructions on how to determine these ranges for each explicitly listed variable, (2) require that each value tested in the sensitivity

analysis be tested under a broad reasonable range of time periods of analysis, and (3) require that residual values be varied when they have been lowered due to political risk considerations. Also, as we stated in the draft, there is no need to vary rent in the sensitivity analysis when the rent is based on a fixed price bid or a bid in which the price varies only due to inflation or exchange rate movements. Varying rent in these circumstances needlessly complicates the sensitivity analysis.

The OSD requirement that in the sensitivity analysis, the analyst determine the point at which a variable would change the analysis's conclusion relieves the analyst from determining a likely range for the variables but results in at least two other problems: (1) this method transfers the responsibility of determining the probable range of future values of the key variables from the analyst to the readers/decisionmakers of the economic analysis, who may have less training and experience than the analyst in making judgments of this type about the future, and (2) where there are more than two alternatives, there can be more than one point at which an alternative becomes the least expensive; these additional switching points may not be determined by the analyst, and as a result insufficient information may be provided to the decisionmaker.

12. A major concern to us is that DOD uses the government's cost of borrowing to determine the least costly alternative as soon as possible. We are concerned that future economic analyses will continue discounting using an inappropriate method, thus adversely affecting their conclusions. Consequently we continue to believe that DOD should request a waiver from OMB, notwithstanding the possibility that other agencies may continue to use inappropriate methods of discounting. We expect that DOD's waiver request will hasten OMB's adoption of the revised Circular A-104.

13. The recommendation has been reworded.

14. We hope that future guidance on sensitivity analyses will follow our recommendations. See comment 11 for the reasons we made these recommendations.

15. See comment 2 for the reasons we made this recommendation.

It should be a reasonably simple matter to estimate the extent to which a host country's tax laws benefit lessors as well as builders. Consequently it is possible to estimate what a lessor's bid would have been if

the tax benefits were not present and then whether the tax laws appear to have affected the results enough for them to be a "special circumstance."

16. An important issue is which method of forecasting would a professional forecaster expect to be more accurate in the future and which less accurate. To answer this question, one would want to know how the methods have performed in the past and any additional factors that should be taken into account in judging their likely performance in the future. DOD has not presented any evidence for preferring the method OSD now requires in formulating exchange rate forecasts. We have presented evidence based on past behavior (Purchasing Power Parity) and on the major U.S. econometric forecasting firms which predict that exchange rates generally will not remain constant over long periods of time. (See comment 10 for more details.)

17. The financial viability of a bid may be suspect for a number of reasons. One is the lack of successful previous experience with the contractor. Another is that the bid is much less than other bids for this alternative or, if there are no other bids for this alternative as was the case for the Air Force study, much less than some other reference alternative, such as the military construction estimate. In such cases, we believe questions should be raised and a fuller investigation of the bid's financial viability conducted. Simply because an entrepreneur bids on a project does not imply that the project should have been expected to be financially viable. The entrepreneur may have been deliberately underbidding believing that additional money would be forthcoming if the financial need arises or he may have made a serious miscalculation due to an overly optimistic expectation about the future compared to that which was at that time reasonable.

18. See comments 6 and 7 for the reasons we made this recommendation.

END

DT/C

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