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COMMENTS ON IDA PAPER P-2863, "A COMPARISON OF AIR FORCE DATA SYSTEMS"

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August 1993

Prepared for
Office of the Assistant Secretary of Defense
(Production and Logistics)

INSTITUTE FOR DEFENSE ANALYSES
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13. ABSTRACT *(Maximum 200 words)*

IDA Paper P-2863 reports on a comparison by IDA of two Air Force maintenance information systems. One of the systems is CAMS/REMIS, which combines the Core Automated Management System (CAMS) with the Reliability and Maintainability Information System (REMIS). The other is the Interim CAMS and REMIS Reporting System (TICARRS). Before Paper P-2863 was released in its final version, IDA gave interested parties the opportunity to comment upon it. This document contains the comments provided to IDA by the Office of the Secretary of Defense, the Air Force, Litton Computer Services, and Dynamics Research Corporation. It also contains IDA's responses to the comments received.

14. SUBJECT TERMS
Aircraft Maintenance, Core Automated Management System (CAMS), Reliability and Maintainability Information System (REMIS), Interim CAMS and REMIS Reporting System (TICARRS), Information Systems, Air Force, Litton Computer Services, Dynamics Research Corporation, Department of Defense, Cost Estimates

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INSTITUTE FOR DEFENSE ANALYSES

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PREFACE

This document was prepared by the Institute for Defense Analyses (IDA) for the Office of the Assistant Secretary of Defense (Production and Logistics) under a task entitled "Comparison of CAMS/REMIS and TICARRS." This document contains comments on IDA Paper P-2863, "A Comparison of Air Force Data Systems," which was prepared under the same task. Paper P-2863 is IDA's final report on an evaluation of the costs and operational effectiveness of two automated Air Force systems for maintenance information.

CONTENTS

I. INTRODUCTION

The Institute for Defense Analyses (IDA) conducted a study of the costs and operational effectiveness of two automated systems for collecting and providing maintenance and related information to the Air Force. One of these systems (CAMS/REMIS) combines the Core Automated Maintenance System (CAMS) and the Reliability and Maintainability Information System (REMIS). The other is the Tactical Interim CAMS and REMIS Reporting System (TICARRS). The outcome of that comparison is documented in IDA Paper P-2863, "A Comparison of Air Force Data Systems." Before the release of that paper, interested parties were given the opportunity to comment on a draft version. Members of the IDA study team met with the interested groups to discuss their comments. IDA considered the information obtained from the meetings in preparing the final version of the paper.

The sponsor in the Office of the Secretary of Defense (OSD) asked that comments and responses be published for the record. This document therefore contains copies of the comments provided by the OSD, the Air Force, Litton Computer Services, and Dynamics Research Corporation. In addition, it contains IDA's responses to those comments.

This document was prepared with the expectation that readers would have access to the draft version of IDA Paper P-2863 (the version being commented upon).

II. THE OFFICE OF THE SECRETARY OF DEFENSE

A. ASSISTANT DEPUTY UNDER SECRETARY (MAINTENANCE POLICY)

OSD Comments:

A copy of the letter from Robert T. Mason, Assistant Deputy Under Secretary (Maintenance Policy), appears on pages II-2 and II-3 of this document.

IDA Response:

1. Alternative 2 MAISRC: We agree and have modified the report to reflect this information.
2. Alternative 2 lines of code: We have re-examined our estimates and provided additional discussion on definitions of lines of code in the report.
3. Alternative 1 data accuracy and responsiveness: We have attempted to include the resources required to improve data accuracy and responsiveness for Alternative 1; however, the inherent system architecture of CAMS/REMIS works against their simple resolution.
4. Impact of F-16 disconnect from TICARRS, CAMS data base quality: We presented information on data quality and logistics measures before and after the F-16 disconnect. We have not addressed the CAMS data base quality problems, because we did not structure a test during the Operational Assessment to assess them. These problems were reported in detail by DRC.
5. Two-level maintenance: Yes, for both alternatives we have included resources for modifications to support two-level maintenance.
6. RPC costs: We have changed our methodology to define these costs, and we have provided additional detail in the report.
7. Review of historical cost/performance: We have considered prior performance both in estimating costs and in assessing the risk of the alternatives.

OFFICE OF THE UNDER SECRETARY OF DEFENSE

WASHINGTON, DC 20301-3000

ACQUISITION

(L/MD)

Institute for Defense Analyses
Attn: Waynard C. Devers
1801 N. Beauregard Street
Alexandria, VA 22311-1772

Dear Sir:

Affected OSD offices conducted a review of the draft of IDA Paper P-2863, "A Comparison of Air Force Data Systems." Inputs are summarized below, and specific comments are attached.

- Alternative #2 (TICARRS) needs to account for MAISRC oversight/approval in terms of both cost and schedule.
- Alternative #2 costing for comparable functionality in terms of lines of new code and cost per line appears low.
- Alternative #1 cost estimate should more specifically account for improved data accuracy and responsiveness.
- Expand (if possible) impact of F-16 disconnect from direct TICARRS input. Expand explanation of data base quality problems in exporting CAMS data to TICARRS 92 at Seymour Johnson AFB.
- Do the cost estimates for both alternatives reflect directly the system modifications necessary to support two-level maintenance?
- Alternative one is extremely sensitive to the CAMS marginal costs at the RPCs. Continue efforts to further define costs, identify sensitivity of conclusions to/level of confidence in the costs.

- Use historical review of cost/performance of prior CAMS/REMIS/TICARRS efforts to help establish a "Level of confidence."

My action officer is Lt Col Dan Falvey, 695-5315, FAX 693-7037.

Sincerely,

Robert T. Mason
Assistant Deputy Under Secretary
(Maintenance Policy)

Enclosures:
1. OASD C3I Memo, July 21, 1993
2. OASD (PA&E) Memo, July 26, 1993

B. DIRECTOR FOR PROGRAM OVERSIGHT, ODASD(C3I ACQUISITION)

OSD Comments:

A copy of the memorandum containing the comments from Col. Johnnie O. Rankin, Director for Program Oversight, Office of the Deputy Assistant Secretary of Defense (C3I Acquisition) appears on page II-5 of this document.

IDA Response:

1. MAISRC requirement: We agree and have modified the report to reflect this information.
2. TICARRS enhancements: We have done additional work on our estimates of lines of code for TICARRS enhancements. We discuss this in detail in the report.

OFFICE OF THE ASSISTANT SECRETARY OF DEFENSE

WASHINGTON, DC 20301-3040

COMMAND CONTROL
COMMUNICATIONS
AND INTELLIGENCE

July 21, 1993

MEMORANDUM FOR DIRECTOR, MAINTENANCE POLICY, ODUSD(LOGISTICS)

SUBJECT: Institute for Defense Analyses Review Version Report "A COMPARISON OF AIR FORCE DATA SYSTEMS"

We have review the subject report and would like the following comments included as part of the OSD comments provided IDA:

- On pages VII-1 and VII-16, IDA has incorrectly assumed that TICARRS would not require OSD MAISRC Milestone III approval before deployment and implementation. Because of IDA's projected life-cycle costs, to be incurred between 1994 and 2003, and the existing special interest in this program, TICARRS should be considered a major AIS program. In turn, it will be subject to MAISRC Milestone III review and approval and the requirements of DoDI 8120.2. For this reason, IDA needs to adjust its costing and schedule for TICARRS completion, testing, and implementation. Major exit criteria that will have to be satisfied before the MAISRC review will be completion of system development, developmental and operational testing to demonstrate that user requirements can be met, economic analysis information updated, and an independent cost evaluation completed.

- On page VII-30, the draft report states that DRC estimates it will take 30,000 lines of code for the eight functional enhancements required for comparability to CAMS/REMIS enhanced capabilities. However, for software maintenance purposes, IDA assumes a growth of 150,000 lines of code. On page VII-21, IDA projects $1,612,800 for this work ($10.75 per line of code). Based on the information provided, the projected lines of new code required for having comparable functionality seems low and the cost per line of code appears very optimistic.

If you have any questions, please contact my action officer, David Dore, at (703) 746-7925.

Johnnie O. Rankin, COL, USA
Director for Program Oversight
ODASD(C3I Acquisition)

C. LEAD CAMS/REMIS MAISRC ACTION OFFICER

OSD Comments:

A copy of the memorandum from David A. Dore, Lead CAMS/REMIS MAISRC Action Officer, appears on page II-7 of this document.

IDA Response:

We have revised the cost and schedule estimates in the report to include a MAISRC review under both alternatives.

OFFICE OF THE ASSISTANT SECRETARY OF DEFENSE

WASHINGTON, DC 20301-3040

COMMAND, CONTROL, COMMUNICATIONS AND INTELLIGENCE

July 30, 1993

MEMORANDUM FOR DIRECTOR, MAINTENANCE POLICY, ODUSD(LOGISTICS)

SUBJECT: Institute for Defense Analyses Review Version Report on CAMS/REMIS and TICARRS Comparison

The Institute for Defense Analysis (IDA) has provided its draft report on their current comparative study of the Air Force Core Automated Maintenance System/Reliability and Maintainability Information System (CAMS/REMIS) and the Tactical Interim CAMS and REMIS (TICARRS) automated information systems. On July 21, 1993 COL Rankin provided our major comments on the draft. This is to further clarify our remarks on the need for MAISRC review.

Whether the CAMS/REMIS or the TICARRS alternative is selected, a MAISRC Milestone III review will be required before either alternative can provide operational support. If the CAMS/REMIS alternative is selected, the expected MAISRC Milestone III approval should be a conditional approval for the GCSAS portion of REMIS, pending completion of the remaining planned CAMS/REMIS improvements and then a total CAMS/REMIS system operational test/assessment. If the TICARRS alternative is selected, the MAISRC Milestone III review would require completion of a full operational test, by an independent testing organization, that results in certification that the validated CAMS/REMIS Mission Need Statement requirements are satisfied.

If you have any questions regarding this matter, please contact me on (703) 746-7925.

David A. Dore
Lead CAMS/REMIS MAISRC Action Officer
Office of the Deputy Assistant Secretary of Defense
(C3I Acquisition)

D. STAFF ANALYST, FORCE STRUCTURE AND INFRASTRUCTURE COST ANALYSIS DIVISION

OSD Comments:

A copy of the memorandum from Francis L. McDonald, Staff Analyst, Force Structure and Infrastructure Cost Analysis Division appears on pages II-9 and II-10 of this document.

IDA Response:

1. CAMS/REMIS data accuracy and responsiveness: We have included resources in our Alternative 1 cost estimates to resolve these issues. The report discusses these resources. We have also considered the historical record of problems in CAMS/REMIS in evaluating the risks of each alternative.
2. Quality control after F-16 switch to CAMS: We have provided as much information as we have on this issue in the report. We do not have sufficient information to conduct a more formal statistical analysis.
3. Two-level maintenance: Yes, for both alternatives we have included resources for modifications to support two-level maintenance.
4. Marginal costs for CAMS at RPCs: We have examined our methodology relative to the RPCs, and the relevant costs are reported.
5. Level of confidence of cost estimates: We have assessed technical risks given the resources estimated for the alternatives rather than assessing the cost risks in detail. Obviously we could reduce technical risk by allocating more resources to particular problems. That produces feasible but not realistic solutions.

OFFICE OF THE SECRETARY OF DEFENSE

WASHINGTON, DC 20301-1000

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MEMORANDUM FOR DIRECTOR OF MAINTENANCE POLICY

SUBJECT: Report on CAMS/REMIS and TICARRS

This memorandum summarizes my assessment of the IDA study that compares CAMS/REMIS with TICARRS. I believe that the study is generally based on a proper analytical framework but needs to be improved in the following areas:

- Given the overwhelming accuracy and responsiveness shortcomings that have been ascribed to the CAMS/REMIS systems in this study, it is clear that the system functional comparison baseline needs to explicitly incorporate the requirements for timely, responsive, and accurate information. The internal Air Force Program Management Directives (PMDs), formalized for these systems, must have addressed the need for timely, responsive, and accurate information as a system objective. (The prolonged existence of these data accuracy and responsiveness problems in CAMS/REMIS is mindboggling and seriously questions the futility of management efforts and analyses based on data/information from these systems.) The cost estimate for alternate #1 (CAMS/REMIS) in this study must specifically account for improving data accuracy and responsiveness. What efforts are being undertaken to accomplish this objective? How were these efforts costed out? What level of confidence (uncertainty) do we have in these cost estimates?

- The study needs to specifically address what happened from a quality control standpoint when the Air Force disconnected the F-16 CDS and utilized CAMS inputs for TICARRS. Additionally, there is a need to document the quality of the database that was utilized at Seymour Johnson AFB for the TICARRS-92 Operational Assessment. What was the error rate for the CAMS data entering the TICARRS? Was the error rate in the database statistically significant?

- As the Air Force transitions from a three level to a two level maintenance concept, the requirement for an integrated management information system that produces accurate and responsive information with real time access becomes very important. The alternatives presented in this study appear to be oriented toward system comparisons in a three level maintenance concept environment. The system functional comparison baseline in a two level maintenance concept environment would give weight to the fact that CAMS/REMIS are essentially "stovepipe" type data systems while TICARRS represents a limited but integrated management information system. The TICARRS has the basic inherent capabilities but its weapon system coverage and functionality (e.g. base supply interface, engine management, etc.) needs to be expanded. The cost estimates for alternative #1 and #2 should then reflect the appropriate system modifications that are required to accommodate the

management visibility requirements associated with implementing a two level maintenance concept.

- The documentation for alternative #1 needs to highlight the methodology used for determining the marginal costs for CAMS at Regional Processing Centers (RPCs). What level of confidence do we have in this methodology? Do changes in CAMS recurring marginal costs have a major impact on the results of the study? If so, how large do thses changes have to be?

- One needs to establish a level of confidence (uncertainty) associated with the cost estimates for alternative #1 and #2. An explicit historical review of the cost and schedule performance for prior CAMS, REMIS, and TICARRS efforts is the appropriate basis for this effort. (Has there been a consistent pattern and experience of meeting projected schedules and milestones? Has there been a consistent pattern with respect to the actual cost of work performed versus the projected cost of work to be performed? Has the deliverables been available for immediate operational use or have additional modifications or reworks been required to permit effective operational use?) The study should disclose this past history to the consumer of the report. Based on past performance, one will find that a distinctly different level of confidence could be assigned to alternative #1 (CAMS/REMIS enhancement) than for alternative #2 (TICARRS enhancement).

The incorporation of these changes should allow this study to provide a proper basis for detemining the most appropriate course for future Air Force maintenance management information systems.

Frank

Francis L. Mc Donald
Staff Analyst
Force Structure and Infrastructure Cost Analysis Division

III. THE AIR FORCE

A. FORWARDING MEMORANDUM

A copy of the forwarding memorandum from John M. Gilligan, Air Force Program Executive Officer for Combat Support Systems, appears below.

DEPARTMENT OF THE AIR FORCE
AIR FORCE PROGRAM EXECUTIVE OFFICE
WASHINGTON DC

JUL 30 1993

MEMORANDUM FOR: ASD(C3I)(Program Oversight)

Subject: Comments on Draft IDA Comparison of CAMS/REMIS and TICARRS

We appreciate the opportunity to comment on the draft IDA report. Our intent was to limit our comments to areas of fact, required assumptions, and the development of conclusions from these facts and assumptions. We avoided editiorial comments on the text itself.

Our review of the draft report uncovered serious shortcomings in its data, analysis, and conclusions. In our judgement these shortcomings are so severe they compromise its credibility. Without resolution of these identified problems the report should not be released.

Our comments are provided in two attachments. The first attachment contains comments which make a substantative difference in the analysis and require additional effort to incorporate into the final report. The second attachment contains comparatively minor comments which would improve the report but would not require additional analysis.

If you have any questions on these comments please contact me. I am ready to provide any needed assistance as IDA moves towards finalizing their report.

JOHN M. GILLIGAN
Air Force Program Executive Officer
for Combat Support Systems

2 Atch
1. Substantative Comments
2. Other Comments

B. SUBSTANTIVE COMMENTS

Air Force Comments:

A copy of the substantive comments from the Air Force appears on pages III-8 through III-18 of this document. The page numbers in both the Air Force comments and the IDA responses that follow refer to page numbers in the review version of IDA Paper P-2863.

IDA Response:

1. Page II-7, second paragraph: We have removed the detailed material about the systems' functions from Chapter II and, instead, rely on Chapter V to define the capabilities of each of the systems. The "bad actor" tracking capability is addressed in Chapter V. However, it should be noted that bad actors refer to part/serial numbers. While this has been performed at OC-ALC, it has not been as widely used as a REMIS function as it has in TICARRS.

2. Page II-12, second paragraph (deficiencies identified in the Seymour Johnson Operational Assessment): Again, we have removed the detailed material about the systems' functions from Chapter II. Relative to this comment, our assessment in Chapter V takes into consideration the findings from the Seymour Johnson Operational Assessment. The Operational Assessment identified three or four serious deficiencies. The SBSS interface, CEMS interface, and so on, were not part of the assessment; it was known in advance that TICARRS could not comply with Air Force requirements in this area. The IDA team has estimated the cost of adding these functions to TICARRS.

3. Page II-12, third paragraph: We agree that most, rather than many, of the aircraft types supported in REMIS are not now supported by TICARRS. We have addressed this issue in detail in Chapter V of the report.

4. Page V-1, first paragraph: CAMS/REMIS was deployed using a highly-structured acquisition process. Both the CAMS segment and the REMIS segment have numerous documented problems, several of which surfaced immediately after the systems were deployed. The Air Force has only begun to address user problems with CAMS, and it has not addressed the lack of consistent availability of reliability and maintainability statistics in the PPS module of REMIS. Sufficient resources have not been programmed into its current budget to address these problems. We agree that TICARRS was developed using a substantially less-structured process. The government and the contractor had considerable freedom in finding ways to meet requirements. Even though it was less structured, the TICARRS acquisition process had mechanisms for ensuring user involvement; it was directed by an Air Force Functional Review Board with representatives from

each of the operating and supporting commands. The approach to developing TICARRS relied largely on rapid prototyping concepts that allowed for gaining agreement on the look and feel of the interface before major programming efforts were undertaken. The TICARRS process for revising and enhancing software to meet user requests is also simpler than that for CAMS/REMIS. TICARRS has addressed the needs of the users and has demonstrated that accurate data were being placed into the system (under direct-entry TICARRS) and that data can be extracted from the system. We acknowledge the comment, and the report has been modified to reflect this information.

5. Page V-13, last paragraph: We agree that "Bright Flag" is a single command initiative and we have provided costs to add a training module to TICARRS. Our draft narrative was not updated to reflect the requirement to provide this module in TICARRS. It has been modified for the final version.

6. Page V-15, first paragraph under "Conclusions Concerning Functionality": We agree that user-defined requirements should be the basis for evaluating CAMS/REMIS and TICARRS functionality. In making this assessment, however, we believed that it was appropriate in our independent assessment to address user requirements that are in the process of being defined by the Air Force. For example, the REMIS ORD is now being re-written. Possible user requirements include, but are not limited to deployment capability and support of two-level maintenance. IDA believes that it is useful to assess the extent to which functions are carried out and how well they perform, for comparison purposes.

7. Page V-15, last paragraph: IDA was hesitant to assemble Table V-1 because of the many nuances involved in the performance of a function. The text points out that within a function, different systems may have relative strengths and weaknesses with respect to component features of the function. Assigning superiority to one system over another, except in a few, clearly dominating instances, implies too much about how to weigh the various functions.

8. Pages V-17 through 37: IDA's assessment of the "operating characteristics" for CAMS was limited to available data, most of which is from the current SBLC architecture. Our assessment does address where we believe that the RPC approach to supporting CAMS could provide advantages; however, many of the problems with the SBLC architecture will continue under the RPC environment.

9. Pages V-21, first paragraph: IDA agrees that both CAMS and TICARRS will be held captive to the base communications infrastructure. Because of limits on the availability of data for the communications contribution to response time, we have discounted that from our analysis. However, about 20 percent of the bases that use CAMS have response-time problems. During our survey of CAMS operations at four bases, we observed cases where response time in CAMS appeared excessive, and there is substantial anecdotal evidence from our interviews with CAMS users

that support this as a major problem. The report states our belief that the situation would improve under the RPC environment.

10. Page V-26, first paragraph: IDA is aware of the response-time requirement in the Functional Description. We also know that with the computer updates to the SBLCs and RPCs and other improvements to the CAMS system, the standard being used at the Standard Systems Center to measure performance is 7 seconds. We believe that this is, in fact, the current objective that the system's performance is being designed to and measured against.

11. Page V-33, "Software Process" subsection: We do not agree that this material is superfluous to the report; nonetheless, we have removed it.

12. Page V-33, "Requirements Management " section: This section does not address the Air Force-defined process to establish requirements within the acquisition process. As explained in the text, it does make a comparison of the systems to the criteria established by Software Engineering Institute for evaluating organizations developing information systems. We have removed this section from Chapter V.

13. Page V-42, comparison of survey results: We agree, and the report has been modified to reflect this position.

14. Page V-43: The factors were based on conversations with users at Seymour Johnson AFB.

15. Page V-44, paragraph 2: We agree, and the report has been modified to reflect this concern.

16. Page V-44, paragraph 3: We do not understand this comment in the context of the stated paragraph in the report.

17. Page V-55 through V-65: We believe that this subsection on adaptability provides important information relative to the capability of the systems to adapt to the future needs of the Air Force and emerging weapon system and information system technology. The report includes sufficient qualifiers for a reader to understand that this is IDA's view of the future based on information obtained from the Air Force and relevant contractors. As a result of internal IDA review, we have restructured the presentation of the material: the portion of the subsection that addresses the future Air Force has been moved to an appendix and the body of the paper contains a summary of that material.

18. Page V-67, second paragraph: We retained this paragraph in the paper. We do not want to leave a reader with the impression that maintenance information systems have no impact on logistics or operational performance of a weapon system. Our conclusion was a statistical one, a failure to reject the null hypothesis. Previous research performed on the CAMS for Airlift system supports the basic hypothesis that maintenance information systems can affect logistics and operational performance of weapon systems. There are two possibilities as to the effects of a

maintenance information system that our analysis does not have the capability to address. First, the effects of the two information systems logistics and operational performance are so similar that we cannot differentiate between the systems. Second, the effects of maintenance information systems can only be measured for a longer period of time than analyzed in our study. The tests provided here only addressed the short-term influences. In sum, we support the view that accurate maintenance information will affect the logistics and operational performance of weapon systems. The tests provided here only addressed the short-term influences. The report has been modified to make this point clearer.

19. Page VI-1, "Areas of Enhancement for CAMS", first paragraph: We agree and have revised the language based on new information provided by the Standard System Center on SBLC performance.

20. Page VI-3, last paragraph: We agree and have removed the requirement for estimating the costs of these improvements from both systems.

21. Page VI-4, last paragraph: We agree and have revised our schedule to include a competitive procurement and MAISRC III decision.

22. Chapter VII overall: We agree. Our objective is to provide enough detail to allow reconstruction of the IDA estimate. Relative to estimates for software cost, we believe that in many cases staff-years represent a more accurate approach to estimating the effort than detailed lines-of-code costing. The narrative description provides our approach to estimating costs; however, where appropriate and where an independent assessment of costs was necessary, we have relied on the Software Production Quality Reliability version 20 (SPQR/20) software cost-estimating model to estimate the costs using lines of code.

23. Page VII-1, second paragraph: We have modified our schedule to accommodate the requirements for a MAISRC as specified by the Air Force.

24. Page VII-2, Non-recurring Hardware Costs: We agree and have modified the report to reflect this information.

25. Page VII-5, Non-recurring Hardware Costs: We have recalculated the costs based on information from the Standard Systems Center.

26. Page VII-5, Non-recurring Software, Application Software, Enhanced Data Editing and Control: We disagree and have done an independent cost estimate.

27. Page VII-6, Non-recurring Software, Application Software, System Integration and Test: We disagree and have done an independent cost estimate.

28. Page VII-7, Recurring Costs, User Support, CAMS Base Representatives: We agree and have modified the report to reflect this information.

29. Page VII-8, Recurring Costs, Software Maintenance, System Integration and Test: We agree and have modified the report to reflect this information.

30. Page VII-8, Recurring Costs, Software Maintenance, Documentation: We used a uniform percentage across all three systems.

31. Page VII-11, Non-Recurring Costs, Hardware: We agree and have modified the report to reflect this information.

32. Page VII-11, Non-Recurring Costs, Software, Performance Improvement: We disagree and have done an independent cost estimate.

33. Page VII-13, Recurring Costs, Computer Operations, Tandem Hardware at the ALCs, Operational Staff: We agree and have modified the report to reflect this information.

34. Page VII-14, G&A and Profit: We agree and have modified the report to reflect this information.

35. Page VII-16, first paragraph (both comments): We agree and have modified the report to reflect this information.

36. Page VII-18, Non-Recurring Costs, Hardware: We agree and have modified the report to reflect this information.

37. Page VII-19, Non-Recurring Costs, Software, Application Software, Functional Enhancements (Provisions for F-22, etc.):We agree and have modified the report to reflect this information.

38. Page VII-19, Non-Recurring Costs, Software, Application Software, Functional Enhancements, Paragraph 2e(1), (Lines of code): We disagree, and we have provided additional discussion of lines of code in the report.

39. Page VII-22, Non-Recurring Costs, Initializing Database for Each Weapon System: We discussed the difficulties of initializing the data base for REMIS, because the baseline estimate included no money for REMIS for this purpose, and it seems to be a formidable task. We have included three times as much money for TICARRS data base initialization.

40. Page VII-25, Non-recurring, Communications, Hardware: We agree and have modified the report to reflect this information.

41. Page VII-26 through 27, Unit Activation: We believe that some factors associated with unit activation will benefit from experience and average costs will be significantly lower than those presented in the comment (e.g., DIREPs). We have allocated sufficient resources to cover these activities.

42. Page VII-28, Recurring Costs, User Support: We agree and have modified the report to reflect this information.

43. Page VII-30, Recurring Costs, Software, Documentation Materials: We agree and have modified the report to reflect this information.

44. Page VII-33, Table VII-10, Element 2.2.3: The costs are different because of phasing in of the operations.

45. Page VII-35, last paragraph: We disagree. No DoD or Air Force regulation automatically prevents the continuation of the MAISRC process for REMIS under Alternative 2.

SUBSTANTIVE COMMENTS

This attachment contains substantive comments on the draft IDA comparison of CAMS/REMIS and TICARRS. Incorporation of these comments into the final report may require additional analysis effort. Comments are keyed to the draft report by page and section.

I Introduction
No substantive comments.

II System Descriptions

A. Core Automated Maintenance System (CAMS)
No substantive comments.

B. Reliability and Maintainability Maintenance System (REMIS)

Page II-7, second paragraph: PPS has a "bad actor" tracking capability comparable to that contained within TICARRS-92; this capability has been demonstrated at OC-ALC, Tinker AFB, OK. Since no formal requirements for "bad actor" tracking have been defined, neither system can be said to have a better ability to meet Air Force needs. To the extent the Air Force has a defined need for "bad actor" identification CAMS/REMIS supports that need.

C. Tactical Interim CAMS and REMIS Reporting System (TICARRS)

Page II-12, second paragraph (deficiencies identified in the Seymour-Johnson Operational Assessment): The Operational Assessment identified serious deficiencies in each of the seven TICARRS subsystems, where the subsystem failed to support critical Air Force maintenance practices, contained functional characteristics which caused increased workload on maintenance technicians, or both. Existing CAMS capabilities in maintenance-supply interface, comprehensive engine management, personnel, and shop production planning, scheduling, and control were not replicated in TICARRS. The Operational Assessment concluded that "As of 8 May 1993, TICARRS-92 cannot support the 4th Wing as a stand alone maintenance data collection system ... I base this solely on

those functional capabilities which were demonstrated during this assessment."

Page II-12, third paragraph: Most, rather than many, of the aircraft types supported by REMIS are not now supported by TICARRS. As referenced later in the report, this includes about 45 aircraft MDS, 9 missile variants, all aircraft trainers, all aerospace ground support equipment, and all communications-electronics equipment.

III Evaluation Considerations
No substantive comments.

IV Sources of Information
No substantive comments.

V Evaluation of Existing Systems

Page V-1, first paragraph: Given the structured nature of the acquisition system under which CAMS/REMIS is being developed and fielded, much formal documentation, analysis, and review exists of this program. Since TICARRS has not been developed under the same rigorous management structure a similar level of study does not exist for this system. This has led to a situation where a great deal of formal documentation, highlighting program status, strengths, and weaknesses exists to assist in the evaluation of CAMS/REMIS; few comparable TICARRS studies are available to support an unbiased evaluation.

Page V-13, last paragraph: "Bright Flag" is a single command's initiative. In order to meet the defined Air Force requirement CAMS/REMIS or TICARRS-92 must contain the required capability to support all Air Force units, both ACC and non-ACC assigned.

Page V-15, first paragraph under "Conclusions Concerning Functionality": The formal acquisition system used within DoD mandates that programs be developed and tested against user-defined requirements. These are the requirements which CAMS/REMIS or TICARRS-92 must support and be measured against. When compared to these requirements CAMS/REMIS has full functionality. Measuring the system against any other set of requirements is inappropriate.

Page V-15, last paragraph: A review of the verbal description of the functionality of the two programs leads to the following assessment:

	CAMS/REMIS Superior	Neither Superior	TICARRS-92 Superior
Equipment Inventory		X	
Equipment Status		X	
Equipment Utilization		X	
Flight Scheduling	X		
MOC Support			X
Debriefing		X	
Maintenance Scheduling and Reporting	X		
Maintenance-Supply Interface	X(1)		
Comprehensive Engine Management	X(1)		
Cannibalization Tracking and Management	X		
Configuration Tracking and Management			X
TCTO Tracking and Mgt	X		
Personnel Tng, Avail, and Mgt	X(1)		
Shop Prod Plng, Sched, and Control	X(1)		
Mobilization Planning		X	
System Deployability		X	

(1) No TICARRS-92 Capability

Pages V-17 through 37: Throughout the "Operating Characteristics" section analysis is conducted on CAMS using the current SBLC architecture; all economic analysis in Chapter VII is conducted using the Regional Processing Center architecture. Costs can not be estimated against one system configuration and operating performance evaluated against a completely different configuration. Consistency in the alternatives evaluated is required for meaningful analysis.

Page V-21, first paragraph: When TICARRS-92 operates as a base-level system replicating CAMS functionality it is held captive to the base communications infrastructure as is CAMS. The Operational Assessment demonstrated that the major factor in system response time is the base communications infrastructure, not the transaction processing time of either the SBLC for CAMS or the TICARRS-92 central mainframe. As the system user sees end-to-end system response time from transmit to receipt of transaction, this is the appropriate measure to use. If TICARRS-92 is populated throughout the Air Force its overall response time on a base-by-base level will be comparable to that of CAMS because of its comparable dependency on the existing and planned communications infrastructure.

Page V-26, first paragraph: The CAMS requirement, as specified in the Functional Description, is for average response times of 10 seconds or less, with a maximum

response time of 30 seconds. Based upon the stated Air Force requirement the response times are acceptable. Additionally, the rationales cited in the paragraph are speculative and unsupported.

Page V-33, "Software Process" subsection: This subsection is superfluous to the report. It does not contribute to the comparison of CAMS/REMIS and TICARRS, and is not referenced elsewhere in the report. Recommend its elimination from the final report.

Page V-33, "Requirements Management" section: The Air Force has a defined process used to establish requirements within the acquisition process. TICARRS, historically managed as an element of the F-16 weapon system, has not come under this process. If TICARRS did become the standard Air Force system it would be required to amend the relatively informal process used to determine and modify functionality and comply with the more restrictive procedures of the acquisition process.

Page V-42, comparison of survey results: Of the 32 separate comparisons of CAMS and TICARRS in Table V-8, 26 (81%) indicated a preference for CAMS. The description of these results do not reflect this preference; instead, the single data element with the most favorable TICARRS support is emphasized. It would be more correct to say that of those expressing a preference, in most instances a weak preference towards CAMS was stated.

Page V-43, last paragraph and supporting bullets on page V-43/44: The factors cited as influencing the shift in survey results are all speculative and unsupported. It could equally be speculated that, as users became more familiar with TICARRS, they recognized that CAMS is easier to use.

Page V-44, second paragraph: The text contradicts the data contained in Table V-8. It would be more correct to say that, at the conclusion of the test, of those selecting a preference a weak leaning towards CAMS was noted.

Page V-44, third paragraph: These statements are unsupported and speculative. The Operational Assessment was structured with the full support and participation of the TICARRS development contractor and were based on representations the contractor had made concerning TICARRS' performance.

Pages V-55 through V-65: In this subsection the draft defines major environmental factors affecting future logistics systems; maps these factors into Air Force requirements; develops a proposed solution to meet these requirements; and develops a program to achieve this solution. However, the multitude of potential decision points in the analysis leads to a wide variety of potential programs, only one of which is addressed. The analysis is extremely sensitive to a wide variety of factors, none of which are covered. Rather than develop Air Force needs through conjecture the analysis would be better served using validated requirements and then justifying any excursions from them.

Page V-67, second paragraph: These comments are speculative and unsupported by the preceding analysis--the report content concluded the source of data, CAMS or TICARRS, made no difference in weapon system performance.

VI Definition of Alternatives

Page VI-1, "Areas of Enhancement for CAMS", first paragraph: This section ignores the contribution of the base level communications infrastructure to CAMS (and TICARRS) performance. As demonstrated at Seymour-Johnson AFB, this infrastructure plays a major role in system responsiveness.

Page VI-3, last paragraph: TICARRS will also require expansion to support the F-22, B-2 IMIS, RAMPOD, Job Cost Accounting, and deployable capability identified for CAMS/REMIS.

Page VI-4, last paragraph: We estimate TICARRS could not be fully fielded until FY 98 vice the FY 96 used. Adoption of TICARRS as the standard Air Force system would require selection of a contractor through a competitive process; development of an ORD and TEMP; conduct of an Operational Test; and fielding approval through a MAISRC III decision.

VII Estimating the Costs of Alternatives

Overall: The final report should provide sufficient detail to allow reconstruction of the estimate. In particular, software estimates are presented in person-years of effort; the basis for these estimates (Lines of Code with productivity indices or other estimating methodologies) must be provided.

Page VII-1, second paragraph: The thresholds for MAISRC review of a program are anticipated program costs in excess of $100M in FY90 dollars; any single year costs in excess of $25M in FY90 dollars; or estimated life cycle cost in excess of $300M in FY90 dollars (DoD 8120.1). In addition, Automated Information System modernization/ modification efforts are also subject to DoD oversight per DoD 8120.1. As such, the TICARRS effort envisioned would require DoD oversight and review prior to fielding. Such oversight entails a formally-conducted Operational Test and Evaluation Program which must be included in an approved TEMP. To obtain an approved TEMP an ORD is required. This chain of activities will significantly lengthen the assumed timelines for fielding TICARRS.

A. Cost Estimates for CAMS

Page VII-2, Non-recurring Hardware Costs: Funding for the Regional Processing Centers will be expended by the end of FY94; no additional funds have been identified beyond this point. The last base migration to a regional center is programmed for January 1995. With the Regional Processing Centers so close to completion the majority of the costs have been incurred and are not subject to change.

Page VII-5, Non-recurring Hardware Costs: The draft IDA analysis used a very simplistic method of allocating Air Force Regional Processing Center costs to CAMS. The methodology used overstates the actual marginal costs of CAMS/REMIS to the Regional Computer Centers. Specifically,

- Six computer systems at each base are being combined into the Regional Centers, not only the SBLC as presupposed.
- The methodology apportioned costs based on the CAMS portion of on-line SBLC transactions; on-line transactions account for only 30-35% of the SBLC processor load.
- The total costs of the Regional Processing Center effort were used to determine marginal costs attributable to CAMS; in actuality, only a portion of the cost of Regional Processing Centers is for processors. The rest is for infrastructure items--printers, communications, and so on.
- All funds for the Regional Processing Centers will be expended by the end of FY94; the ability to influence future spending is limited to a portion substantially less than the full amount.

(Note: A meeting on the costs elements of the Regional Processing Centers and their cost apportionment to CAMS was held at Gunter Annex to Maxwell AFB on July 23 to provide additional detailed material to IDA team members.)

Page VII-5, Non-recurring, Software, Application Software, Enhanced Data Editing and Control: Internal Air Force estimates for this effort are for five person-years of effort.

Page VII-6, Non-recurring, Software, Application Software, System Integration and Test: This effort is currently conducted at a two person level of effort; the rationale for the increase to 15 is unsubstantiated.

Page VII-7, Recurring Costs, User Support, CAMS Base Representatives: These individuals will not fill new positions. Instead, existing positions are being converted to support this effort. Estimates are that 50-75% of the positions will come from CAMS Data Base Managers, who are already included in the estimate. Accordingly, using the lower bound of 50%, only half of these costs will represent a marginal increase.

Page VII-8, Recurring Costs, Software Maintenance, System Integration and Test: This effort is currently supported by five full-time and two half-time positions, for an equivalent level of effort of 6 full-time positions. The projection that half of the 75 positions support CAMS is in error.

Page VII-8, Recurring Costs, Software Maintenance, Documentation: This effort is currently supported at a five person level of effort, not the two cited in the analysis.

B. Cost Estimates for REMIS

Page VII-11, Non-recurring Costs, Hardware: The estimate should reflect the 20% compound annual cost reduction used in the CAMS and TICARRS estimates.

Page VII-11, Non-recurring Costs, Software, Performance Improvement: The estimate should be for 15 staff years for one year, vice the three estimated. Initial analysis of the required performance improvements recommended by the performance monitoring team indicated the effort would be accomplished using 12,315 direct manhours, about 6.5 manyears. This effort would be accomplished in a single year to more rapidly achieve the performance enhancements.

Page VII-13, Recurring Costs, Computer Operations, Tandem Hardware at the ALCs, Operational Staff: These are unmanned centers which require only casual support. They will be operated from the NCC in a "lights out" mode. User support and operation of the computer systems are co-functions of the NCC and are part of the projected manning for NCC operations. No additional manning is required for the ALC sites.

Page VII-14, G&A and Profit: G&A and profit are applied inconsistently to the estimates for CAMS, REMIS, and TICARRS. Each of the three estimates as done by IDA contains a mix of hardware, government personnel, and contractor personnel. However,

- No G&A and profit charges are applied to CAMS.
- G&A and profit charges are applied to all estimated REMIS costs.
- G&A and profit charges are applied to the majority of estimated TICARRS costs; the reason selected costs are not covered is undefined.

C. Cost Estimates for TICARRS

Page VII-16, first paragraph: Assumed schedules must be adjusted to account for ORD and TEMP development, Operational Test and Evaluation, MAISRC Milestone III review, and the required competition of contractor effort.

Page VII-16, first paragraph: The additional marginal costs associated with the above activities must be included in the estimate. As a point of comparison, the Operational Assessment at Seymour-Johnson cost about $1.3M; Operational Test and Evaluation is more expensive than an Operational Assessment.

Page VII-18, Non-recurring Costs, Hardware: a back-up to the single TICARRS computer center will be required and must be included in the estimate. Since under the centralized approach used by TICARRS sortie generation for each and every base, both training and wartime, would be dependent on the central computer extensive back-up provisions are mandatory.

Page VII-19, Non-recurring Costs, Software, Application Software, Functional Enhancements: Provisions for F-22, B-2 IMIS, RAMPOD, deployable TICARRS, and other systems

enhancements must be included to preserve comparability with the CAMS estimated costs.

Page VII-19, Non-recurring Costs, Software, Application Software, Functional Enhancements: Paragraph 2e(1), page VII-30, indicates DRC estimates it will take approximately 30,000 lines of code to provide the eight functional enhancements. Based on the LOC provided by CSCs within the CAMS system, this appears to be a significantly underestimated. The following table shows the unique LOC currently used by CAMS for these functions (Note: this does not include additional LOC used for the PROCs within the programs.)

	EXECUTABLE CODE	EXECUTABLE CODE WITH REMARKS
Supply	29514	31718
CEMS	84086	94305
Personnel	27257	28534
Training	55417	59344
Production Mgt	2083	2254 (1)
Automated Forms	19564	22630
PQDR	11509	13220
Maint Snapshot	2421	2440 (2)
Subtotal (excl C-E)	231851	254445
Comm Electronics	27342	30677
TOTAL incl C-E)	259193	285122

Note 1: Only NFSJ20, screen 380. The production management function includes more than just screen 380. However, only this one program was counted because it is the only screen referenced in the IDA report.

Note 2: Only NFSP60.

CAMS currently has 1.1 million lines of code (LOC) for all systems. Excluding the 285,000 LOC for these eight enhancements leaves about 815,000 LOC for capabilities similar to those in TICARRS. Paragraph 2b, page VII-20 indicates that TICARRS has 850,000 LOC. This statistic indicates that TICARRS uses about the same number of LOC as CAMS for similar functions. Based on this fact the LOC needed for the eight enhancements appears to be between 250,000 and 285,000, not the 30,000 LOC estimated by DRC.

Page VII-22, Non-recurring Costs, Initializing Database for Each Weapon System: The comparable cost estimating section for REMIS contained a description of the difficulty associated with this effort, presumably to establish the risk involved. Since the TICARRS estimate for this effort

is greater than that for REMIS by a factor of four, a similar description of the risks involved is appropriate. Such a discussion is particularly apt, given the extensive problems encountered in database initialization in the Seymour-Johnson AFB Operational Assessment.

Page VII-25, Non-recurring, Communications, Hardware: Costs associated with establishing a back-up site must be included.

Pages VII-26 through 27, "Unit Activation": DRC proposal #P9320 for the Operational Assessment at Seymour-Johnson AFB reflected significantly different estimates. The estimate for activating a unit, based on experienced costs, is

- Site Surveys: 80 hours at $51.05/hour=$4,084
- Load CAMS Data: 320 hours at $60/hour=$19,200
- User Training: 1,388 hours at $52.94/hour for 3 units=$24,494/unit
- Resolve Difficulty Reports: The proposal for DRC staff at Andover MA to work DIREPs and related problems to support the Operational Assessment was 4,208.5 hours. The report states 150 DIREPs were processed for an average of 28 hours per DIREP. Presuming that DIREPs fall from 50 per unit to 15 per unit during implementation, the average DIREPs per unit would be 32.5. 32.5 DIREPs/unit X 28 hours/DIREP X $60/hour=$54,600/unit
- Short Term Site Support: At Seymour-Johnson the contractor proposed five people for six weeks. 1,200 hours X $35/hour for 3 units=$14,000/unit
- Travel and Living (Training): At Seymour-Johnson the contractor proposed 13 personnel for a 20 day period to provide training for 3 units. 260 days X 100/day for 3 units=$8,667/unit.
- Travel and Living (Short Term Support): The contractor proposed five people for six weeks for 3 units. 38 days X 5 people X $100/day for 3 units=$6,333/unit.
- Travel and Living (Site Survey): DRC proposed two people for five days for 3 units. 10 days X $100/day for 3 units=$333/unit.

The total per unit based on DRC proposed costs is 131,711 per unit for a total of $34,771,704.

Page VII-28, Recurring Costs, User Support: No costs are included for a central "help desk" to accomplish tasks and provide support to users above the base level. The analysis should indicate either such user support is not required or provide an estimate of its cost.

Page VII-30, Recurring Costs, Software, Documentation Materials: Current TICARRS documentation does not meet DoD standards; the estimate should reflect increased costs to upgrade this documentation to comply with requirements.

D. Cost Comparison of Alternatives

Page VII-33, Table VII-10, Element 2.2.3: The 1994 CAMS cost for Base Communications Operations are higher than those estimated for the same effort in the CAMS-specific effort in 1994. The differing costs need to be reconciled.

Page VII-35, last paragraph: Under Alternative 2 current systems programmed to be replaced by CAMS/REMIS will operate for up to an additional three years, compared to Alternative 1. The costs of the continued operation of these current systems should be included in the analysis of Alternative 2 as a marginal cost.

C. OTHER COMMENTS

Air Force Comments:

A copy of the other comments from the Air Force appears beginning on page III-24 of this document. The page numbers in both the Air Force comments and the IDA responses that follow refer to page numbers in the review version of IDA Paper P-2863.

IDA Response:

1. Overall (treatment of CAMS and REMIS as separate programs): Although CAMS/REMIS is the Air Force maintenance data system, CAMS and REMIS were developed separately. Their architecture, hardware, and management are different. Availability of cost data for CAMS and REMIS varied greatly. We have treated CAMS and REMIS separately in the descriptive parts of the report and for general cost-estimating purposes. They have been treated as one entity for the formal alternatives. We believe this treatment is appropriate, and the report has been modified to clarify this stance.
2. Overall (observations): It has been necessary to use our own direct observations to supplement data provided by others. We have been careful to label perceptions as such in the text.
3. Page I-1, second paragraph: We acknowledge the comment. We believe that the text presents accurately the rationale for the study.
4. Page II-1, first paragraph: We agree, and the report has been modified to reflect this information.
5. Page II-1, second paragraph, first bullet: We agree, and the report has been modified to reflect this information.
6. Page II-2, third bullet from top: We agree and have modified the report to reflect this information.
7. Page II-2, third bullet from the top: We agree and have modified the report to reflect this information.
8. Page II-3, first bullet (both comments): Chapter V has been modified to reflect this information.
9. Page II-2 second paragraph, second bullet: As previously mentioned, we have removed the detailed material about the systems' functions from Chapter II. We have carefully considered the requirements for TICARRS to replicate this function.
10. Page II-3, "System Configuration and Management", second paragraph: We have modified the report to clarify this issue.

11. Page II-4, "Current Status and Future Plans", "Status", second bullet: We agree and have modified the report to reflect this information.

12. Page II-4, "Current Status and Future Plans", "Status", third bullet: We have modified the report to reflect this information.

13. Page II-5, paragraph 4: We have modified the report to reflect this information.

14. Page II-6 first paragraph: Again, we have removed the detailed material about the systems' functions from Chapter II, relying instead on Chapter V to describe each of the system's capabilities.

15. Page II-8, "System Configuration and Management": The discussion here is intentionally brief.

16. Page II-9, second bullet at top of page: We agree, and the report clearly states the Air Force point.

17. Page II-9, "Functional Overview", third bullet: TICARRS has a deployable system that was used for the F-117 aircraft in the Persian Gulf War.

18. Page II-9, "Functional Overview", second paragraph: We acknowledge the comment.

19. Page II-9, last paragraph, and page II-10, first three paragraphs: We have revised Chapter II so that it is a more general overview of the system's functions. When describing a system's functions, we do not mean to imply that they are unique to that system.

20. Page II-12, last paragraph: DRC's analyses of the work needed to expand TICARRS have been independently reviewed by IDA, and we have developed an independent cost estimate in the report.

21. Page III-10, "The Organization of Weapons System Management": We have modified the report to reflect this information.

22. Page IV-9, first paragraph: We have done an independent categorization of the DIREPs and FDWWs. We have included a fuller discussion in the final report.

23. Page IV-9, last paragraph: It was unclear how serious many of the FDWWs were, especially those that reported data and communications problems. In fact, many of the FDWWs were "fixed" through the DIREP process during the assessment (we know that this may not have been the correct action to take, but the fact is that the problems could not have taken substantial resources to fix if they were completed so quickly).

24. Page V-2, "Background", sub-paragraph (3): The report has been modified to reflect this information.

25. Page V-3, Table V-1: IDA understands the claim regarding narrative data in REMIS. There has been no demonstration that the narratives can be retrieved. Bad

actors are identified by part/serial number, not WUC. Regarding cannibalization actions, we agree and the report has been modified to reflect this information. GCSAS is not now fielded but other changes have been made to the table. The text and table have been revised to include cannibalization tracking.

26. Page V-5, last paragraph: The report has been modified to reflect this information.

27. Page V-6, second paragraph: The report has been modified to reflect this information.

28. Page V-9, second paragraph: We understand but can give no credit for planned development.

29. Page V-9, third paragraph: The report has been modified to reflect this information.

30. Page V-10, first paragraph: The report has been modified to reflect this information.

31. Page V-14, "Mobilization Planning", second paragraph: We agree, and the report has been modified to reflect this information.

32. Page V-14, "System Deployability": We agree; however, a deployable system was used for the F-117s in the Persian Gulf War.

33. Page V-13, third paragraph: In the final report, we have treated engines with the CEMS interface and communications-electronics equipment as part of scope.

34. Page V-17, second paragraph: Given the low usage levels of REMIS and the results of our own observations, we believe the text is appropriate. The importance of narratives is addressed elsewhere in the chapter.

35. Page V-19, first bullet: We have expanded our discussion of this issue in the final report to include management decisions that impact on availability.

36. Page V-19, last paragraph: See note 34, above. The expanded treatment should clarify the issues.

37. Page V-20, fourth paragraph: We do not believe "frequently" implies universality.

38. Page V-26, last paragraph: We disagree. Subsequent analyses substantiate our language.

39. Page V-27, first paragraph: We agree and have modified the report to reflect this information.

40. Page V-30, Table V-5: While TICARRS currently shares a computer with other applications, it would have a dedicated computer system if it were expanded to cover the entire Air Force.

41. Page V-30, last paragraph: We do not believe the text implies that CAMS's operational effectiveness is wholly dependent on base-level ADP personnel. The

fact remains that, under the current system, these personnel have great responsibility.

42. Page V-31, "Shared/Dedicated", first paragraph: We have modified the text to remove the speculative statements.

43. Page V-34, "Software Project Tracking and Oversight": Noted.

44. Page V-37, second paragraph: Noted.

45. Page V-38, "Observations/Discussion with Users", second paragraph, sixth bullet: While training may have been rated good, users complained to the IDA team about the quality of on-line help. Opinions of the effectiveness of training may change weeks after the class, as trainees try to implement what they have learned in the field. We also met many people who were given disks to access REMIS with no training.

46. Page V-38, second paragraph, second bullet under MAJCOMS: Noted.

47. Page V-39, fourth bullet: As previously noted, opinions of the effectiveness of training may change weeks after the class, as trainees try to implement what they have learned in the field.

48. Page V-39, first paragraph: The IDA study team found no contractor—Rockwell, Lockheed Georgia, Lockheed-Fort Worth, or McDonnell-Douglas—who preferred using on-line REMIS to receiving D056 tapes. A list of our contacts will be provided to the REMIS PMO.

49. Page V-46: This may result in some improvement, but the capability has not been demonstrated.

50. Page V-47, second paragraph: We agree and have modified the report to reflect this information.

51. Page V-47, third paragraph: We agree and have modified the report to reflect this information.

52. Page V-47, third paragraph: We agree and have modified the report to reflect this information.

53. Page V-47 through V-48, last paragraph/first paragraph: Noted. We stand by our assessment.

54. Page V-48, "Coronet Deuce Experience": Noted. Users have indicated to us that the difficulty of using CAMS means that maintainers sometimes do not document their actions in CAMS. This is a likely cause of some of the inaccuracy.

55. Page V-49, "Data Loss Problems": Noted.

56. Page V-53, "Integrity and Security of Data Input" subsection: We have modified and condensed this discussion.

57. Page V-53, last paragraph. We agree and have modified the report to reflect this information. We have also expanded our discussion of security.

58. Page V-54, first paragraph: Noted.

59. Overall Comment on Wording: We have modified the report to reflect this information.

OTHER COMMENTS

This attachment contains other comments on the draft IDA comparison of CAMS/REMIS and TICARRS. These comments are comparatively minor ones which would improve the report but not require additional analysis to incorporate into the final version. Comments are keyed to the draft report by page and section.

Overall

Throughout the report CAMS and REMIS are treated as separate programs. There is a single Air Force program, CAMS/REMIS. The final report should reflect this title; where necessary to identify functionality or costs to a selected element of CAMS/REMIS the terms "CAMS segment" or "REMIS segment" should be used.

Throughout the report much use is made of "observations", "perceptions", "beliefs" and "attributions" as facts and conclusions. While observations, perceptions, and beliefs are data used to develop facts and conclusions, they are not in themselves facts and conclusions and should not be presented as such.

I Introduction

Page I-1, second paragraph: The CAMS segment also supports NATO AWACS and the Royal Netherlands Air Force.

Page I-1, last paragraph: The GAO-identified deficiencies were in fact surfaced by the program office; solutions to the problems are well underway and in some cases completed. The solutions were reviewed and accepted by the MAISRC.

II System Descriptions

Page II-1, first paragraph: The word "currently" should be removed from the first sentence. CAMS is the standard Air Force base-level maintenance information system, and no plans exist to provide this functionality through other means.

Page II-1, second paragraph, first bullet: The Job Data Documentation (JDD) subsystem is more than an automated

349. In conjunction with the Maintenance Events subsystem, it provides a production management system for maintenance activities. CAMS is geared toward production management whereas TICARRS is geared toward data collection. The Maintenance Events subsystem provides the user the capability to create, schedule, change, defer, reschedule and cancel events and work center events. The subsystem provides management products to aid the user in forecasting and monitoring inspection and time change requirements. A distinct advantage the subsystem provides is the work center event. This allows the control and monitoring of work flow, especially where multiple shops support a maintenance event.

Page II-2, third bullet from top: The Interim Direct Line Reporting (ILDR) is not part of CAMS.

Page II-2, third bullet from the top: Additional CAMS functions added since 1985 not mentioned are

- Automatic Test Equipment Reporting System (ATERS). This subsystem provides on-line access to a database containing organization, equipment, status, and utilization data for assigned test equipment. It also keeps track of the capability of various test stations to test particular parts. This permits the Avionics Intermediate Shop to update the appropriate data in the database in an on-line mode as events occur which affect assigned test equipment.

- Product Quality Deficiency Reporting (PQDR) Subsystem. The PQDR subsystem reports known or suspected deficiencies for equipment, weapon systems, or related components and records exhibit disposition instructions and data. This subsystem has an interface to INFOCEN that allows approved PQDRs to be transmitted directly to INFOCEN via CAMS.

Page II-3, first bullet: An additional bullet is needed to specify that CAMS has the capability to deploy a suite of communications hardware to maintain connectivity to home station. This suite will enable the users to maintain connectivity to home station as long as some source of communications (dial-up, DDN, etc.) is available. This equipment is available via standard Air Force contract. Additionally, the capability to utilize mobile terminals using radio frequency modems has also been added to the standard Air Force contract.

Attachment 2

Page II-3, first bullet: An additional bullet is needed to specify that CAMS incorporates a Communications-Electronics Subsystem. This subsystem provides on-line access that permits job control to update appropriate data as events occur which affect assigned equipment and missions. It also provides methods for reporting inventory gains and losses, mission gains and losses, and maintains status and utilization.

Page II-2, second paragraph, second bullet: Automated Forms is a separate subsystem of CAMS and should not be included with Automated Debriefing. The Automated Forms subsystem provides the capability to identify discrepancies to be included in the automated 781 series forms. The subsystem retrieves aircraft maintenance data from CAMS and uses it to prefill the 781 series forms.

Page II-3, "System Configuration and Management", second paragraph: When lines of code are used throughout the report compiled or uncompiled should be specified.

Page II-4, "Current Status and Future Plans", "Status", second bullet: Follow-on CEMS interface in in-work.

Page II-4, "Current Status and Future Plans", "Status", third bullet: The deployable CAMS was used in Desert Storm.

Page II-5, paragraph 4: Throughout the draft report the respective roles of the Data Base Administrator (DBA) and Data Base Manager (DBM) are intermixed. These two roles are separate and distinct. DBAs work within the SBLC computer center, and will be incorporated into the Regional Processing Centers. DBMs are individuals within the maintenance organizations who are responsible for the actions required to maintain the CAMS/REMIS capability within their assigned units. As an example, the DBA is responsible for loading a new software release on the SBLC; the DBM is responsible for notifying affected personnel of the impact of any changes on their use of the system (new procedures, screens, capabilities) and when the changes will become effective. DBMs currently accomplish tasks beyond those of the TICARRS site representative, such as repairing pointer errors in the data base, or developing and executing Query Language Program inquiries.

At the unit level some type of system support will be needed, by either CAMS/REMIS or TICARRS. Eliminating the DBAs in the base computer system will not affect this need.

Page II-6, first paragraph: This description of REMIS functions should also include Inventory Control through maintaining the Air Force Master Inventory, Inventory Assignment, and Inventory Possession; weapon system status, both current and historical, for aircraft, missiles, trainers, automated test equipment, and communications-electronics equipment; utilization information such as actual and allocated flying hours, actual sorties, landings, and full stop landings.

Page II-8, "System Configuration and Management": A description of the communications architecture supporting the REMIS segment should be provided.

Page II-9, second bullet at top of page: Contractors have had difficulty obtaining access to REMIS because of security policy issues, not because of system architecture or hardware issues unique to REMIS. Similar problems will be experienced by any automated system until the appropriate policy has been defined.

Page II-9, "Functional Overview", third bullet: TICARRS does not provide a deployable system. It does support a deployable communications capability, in the same manner that CAMS or REMIS can be accessed world-wide with appropriate communications links.

Page II-9, "Functional Overview", second paragraph: Only two of the five Air Logistics Centers currently use TICARRS.

Page II-9, last paragraph, and page II-10, first three paragraphs: These capabilities are also resident in CAMS/REMIS. No differentiation is provided between features common with CAMS/REMIS and any unique TICARRS functionality; the implication in this section as written is only TICARRS supports the listed capabilities.

Page II-12, last paragraph: DRC effort to analyze the work needed to expand TICARRS has been accomplished independently of the Air Force and has not been validated by any outside organization.

III Evaluation Considerations

Page III-10, "The Organization of Weapons System Management", first paragraph: The Air Force has adopted, not is planning to adopt, IWSM.

IV Sources of Information

Page IV-9, first paragraph: A total of 416 FDWWs and 149 DIREPs were developed in the Seymour-Johnson AFB Operational Assessment. These FDWWs and DIREPs were broken out into six categories, with DRC DIREPs directly linked to resolving identified deficiencies. The breakout was

	Software	Database	Training	Communications	Security	Other
Number FDWWs	155	92	80	32	12	45
Number Associated DIREPs	90	32	17	0	7	2

As noted in the final report of the Operational Assessment, Functional Disconnects identified 180 different software related problems.

Page IV-9, last paragraph: The text requires modification to reflect the seriousness of the FDWWs and DIREPs written during the Operational Assessment and the software modifications made in response. As a point of fact, the Air Force Operational Test and Evaluation Center (AFOTEC) does not allow software changes during an Operational Test; if the Operational Assessment had been a formal Operational Test TICARRS-92 would most likely have been evaluated as not operationally effective/suitable.

V Evaluation of Existing Systems

Page V-2, "Background", sub-paragraph (3): Each system was based on different requirements, distinct from perceived needs. TICARRS was developed by individual weapons systems program offices to provide certain logistics tracking capabilities for a limited set of items; CAMS/REMIS was

developed to meet Air Force wide maintenance and logistics needs established through validated requirements.

Page V-3, Table V-1: The following corrections are needed:

- REMIS does receive and maintain narrative data on debriefing failure history and corrective action under DDN.
- REMIS does contain serialized part maintenance history and provides bad actor identification by WUC.
- REMIS, under PPS, tracks and outputs all cannibalization actions.
- TCTO management requires both TCTO Master Information and TCTO Status. REMIS GCSAS supports both of these functions; TICARRS supports only TCTO Status.
- REMIS supports cannibalization tracking.

Page V-5, last paragraph: CAMS supports automated test stations by providing availability data through the Automated Test Equipment Reporting Subsystem (ATERS); that function was not used at Seymour-Johnson.

Page V-6, second paragraph: Errors pushed back to CAMS from REMIS for correction are not dropped after an interval of time.

Page V-9, second paragraph: Base-level users do have access to REMIS today; they do not have access through CAMS terminals, although that capability is being developed.

Page V-9, third paragraph: The first CAMS increment, IB, was fielded at Dyess AFB, TX in 1985 to support the B-1. No REMIS capability existed at that time, forcing the B-1 contractor to extract CAMS data in its own data base.

Page V-10, first paragraph: The portions of the maintenance community were positive about TICARRS' capabilities should be specified.

page V-14, "Mobilization Planning:, second paragraph: The interface with COMPES was determined not to be cost effective and was deleted from CAMS requirements. CAMS has

the capability to identify personnel to a given Mobility Group Number. Once this is accomplished CAMS personnel and training records are provided to the mobility office. There is no requirement for an automated interface between CAMS and COMPES. It was determined that the manual process does support the COMPES requirement.

page V-14, "System Deployability": No requirement has been defined; until this occurs neither CAMS/REMIS nor TICARRS has sufficient direction to develop a robust deployable capability.

Page V-13, third paragraph: Engines and communications-electronics equipment will have to be added in addition to missiles and simulators.

Page V-17, second paragraph: The implicit conclusion that TICARRS is significantly superior to CAMS/REMIS because it provides "important narrative information" is unsupported by the previous analysis.

Page V-19, first bullet: As a general rule the SBLCs are required to be available 24 hours a day, seven days a week; however, on an exception basis, individual bases have made the management decision to close down the computer center on evenings and weekends. Use of the data in the draft report would require a base-by-base analysis to determine the cause of the availability rates. Examples of bases with planned availability rates below 80% are

- Travis AFB, CA: 5 days/week, 0715-1730
- Goodfellow AFB TX: 5 days/week, 0730-2400
- Edwards AFB CA: 5 days/week, 0730-1630
- Lowrey AFB CO (base closing): 5 days/week, 0500-2300
- Shaw AFB NC: 5 days/week, 0630-1700, plus 1 UTA/month 0630-1700
- Bergstrom AFB TX (base closing): 5 days/week, 0700-2200
- Chanute AFB IL (base closing): 5 days/week, 0600-2400

In addition, bases supporting strategic airlift missions use the G081 system (CAMS for Airlift) rather than the CAMS.

Attachment 2

Examples of strategic airlift mission bases with planned system availability less than 80% are

- Travis AFB CA: 5 days/week, 0715-1730
- Dover AFB DE: 5 days/week, 0600-2400 plus 3 UTAs/month 0600-2400

Page V-19, last paragraph: The reasons advanced for the SBLC availability rate are speculative and not supported by data within the draft report.

Page V-20, fourth paragraph: The DCP has been identified as the cause of poor response times at one base; no data exists as to the universality of this problem. The word "frequently" is speculative and unsupported.

Page V-26, last paragraph: The last sentence is speculative and unsupported; it expresses conjecture with no analysis or fact.

Page V-27, first paragraph: The Air Force regional processing centers are sized at 16 megaword (64 MB) not 48 MB.

Page V-30, Table V-5: TICARRS, as mentioned in the text, operates in a shared and not a dedicated environment.

Page V-30, last paragraph: CAMS operational effectiveness depends on many more factors than the base-level ADP personnel. The capabilities of the base communications infrastructure, the adequacy of user training, and management procedures within the maintenance complex are all factors which have a major impact on operational effectiveness and which are beyond the control of the ADP function.

Page V-31, "Shared/Dedicated", first paragraph: The evidence referenced is not specified; as it stands the conclusion is unsupported and speculative.

Page V-24, "Software Project Tracking and Oversight": The CAMS program office has complied with all applicable government program management and oversight practices and procedures, as they have evolved since the program's

inception a decade ago. The cost accounting practices used do not supported the types on marginal costing required by this analysis; they were never developed to and no requirement has ever existed. As the program complies with Defense Business Operating Fund required practices such information will be available in the future.

Page V-37, second paragraph: As referenced elsewhere in the report, corrective action to remedy editing problems between CAMS and REMIS segments is underway.

Page V-38, "Observations/Discussions with Users", second paragraph, sixth bullet: To date, REMISTALK training has trained 151 students. The students have consistently rated the instructor, course materials, and overall course content above average to excellent on the REMISTALK critiques. The record shows that 95% of the students consistently rated all areas above average.

Page V-38, "Observations/Discussions with Users", second paragraph, second bullet under "MAJCOMs": Data is downloaded daily by REMIS users. An explanation of the statement is required to determine if the statement refers to communications, LAN or other unidentified problems.

Page V-39, fourth bullet: Litton Computer Systems has developed and conducted three REMIS courses for the Air Force between 1987 and 1993. To date, REMIS end-user training has trained over 1,666 students. Students have cited the instructors as outstanding, as rated the course content as excellent. Six of the students have been contractor personnel. five of the six rated all areas and the CAI as a "5" or "6" on the student critiques.

Page V-39, first paragraph, "Contractors have the following opinion": During October 1992 through April 1993 more than a dozen contractors who receive D056 data on tape were contacted. Each was offered the option of continuing to receive product performance data on tapes, logging-on to REMIS to view the data, or having the data sent via DDN to their computers. None of the contractors elected to continue to receive data on tapes.

Page V-46, CAMS/REMIS currently has software in testing which enables a CAMS user to query the REMIS database in on-line real time mode. This is the first step in providing CAMS base level users with fleet-wide data validation at the

time the data is initially entered into CAMS. This capability is a viable alternative to a single centralized system architecture.

Page V-47, second paragraph: The difference methods used to round flying hours in EIMSURS has been corrected. REMIS and CAMS now round flying hours using the same algorithms.

Page V-47, third paragraph: No edits have been softened in either CAMS or REMIS. Doing so would adversely effect the accuracy and integrity of the data.

Page V-47, third paragraph: Manual loading of CAMS data was completed in June 1993 as planned.

Page V-47 through V-48, last paragraph/first paragraph: Procedures are currently being defined and implemented to ensure synchronization of both systems. The assessment that regionalization will make it more difficult is based on the assumption that it will reduce the number of data base managers, while in fact, regionalization does not effect the number of DBMs. The functions of the data base manager remain unchanged. End of month reports, data base fixes, as well as generally helping the CAMS user will remain activities of the data base manager at any given base. The bulk of the error correction from REMIS goes to and should be corrected by the user or originator of that transaction. The data base manager becomes involved only when necessary to correct a serial number, organization record, or similar element.

Page V-48, "Coronet Deuce Experience": Without supporting information the true cause of the problem can not be identified. There have been two potential causes proposed. First, the TICARRS data transfer file from base level CAMS may not have been sent and the NRTS actions picked up. This is unlikely because the data should have been sent on the next TICARRS transmission. In addition, the data base manager should have been notified if file was not received. Second, and most likely, the NRTS action was never documented in the CAMS data base. During initial Coronet Deuce testing at Hill AFB, this was a common problem. Coronet Deuce test managers established procedures to validate the NRTS action before an LRU was accepted for shipment. Coronet Deuce is in prototype stages and as with any test project problems must be identified and resolved.

Attachment 2

Page V-49, "Data Loss Problems": The problems identified by Lockheed have been corrected or will be corrected shortly. One fix was released in July (9307), one is scheduled for the November (9311) release, and the remainder are scheduled to be released with GCSAS (9401).

Page V-53, "Integrity and Security of Data Input" subsection: This section is based on formal reviews of SBLC and REMIS security procedures and capabilities. No similar studies have been conducted on TICARRS; the text is misleading in not recognizing the lack of a comparable TICARRS review.

Page V-53, last paragraph: The cited AFAA audit report referenced accessing communications processors; there is a significant distinction between accessing a communications processor and a computer system. CAMS has user identification and password protection to prevent unauthorized access to the required security level. Additionally, the cited problems with "overstating the quantity of parts on hand" references the Standard Base Supply System; CAMS does not contain the capability to modify SBSS supply records. With the lack of a comparable review of TICARRS, its adequacy under equivalent conditions is unknown.

Page V-54, first paragraph: The REMIS GCSAS software was modified in January 1993 to provide user access restriction by Equipment Designator (id KC-135 vs C-141) for all approved configuration data. This modification is scheduled to be fielded prior to the first weapon system being implemented within GCSAS.

VI Definition of Alternatives

No additional comments.

VII Estimating the Costs of Alternatives

IDA correctly accomplished an independent estimate of the CAMS/REMIS and TICARRS costs. However, in some cases the language used to describe the estimating methodology reflects uncritical acceptance of DRC estimates. For example

- Page VII-18: "Based upon data collected by DRC. . ."

Attachment 2

- Page VII-20: "DRC has provided us with a formal impact analysis. . ."
- Page VII-21: ". . .we are using the DRC estimates of staff hours."
- Page VII-26: ". . .based upon a written description provided by DRC."
- Page VII-26: "DRC reported that the CAMS data at Seymour-Johnson were extremely error-prone. . ."
- Page VII-27: DRC reported that these DIREPs averaged 20 hours apiece to research, resolve, retest, . . "
- Page VII-30: "DRC estimates an additional 30,000 lines of code for the eight functional enhancements."

The text should be revised to reflect IDA estimates of these tasks, using DRC-supplied data as one element of the analysis.

Attachment 2

IV. LITTON COMPUTER SERVICES

A. FORWARDING LETTER

A copy of the forwarding letter from Thomas F. King, REMIS Program Director, Litton Computer Services (LCS), appears below.

Litton
Computer Services

[illegible]
[illegible]
45430
(513) 429-6450

26 July 1993

Mr. Waynard C. Devers
INSTITUTE FOR DEFENSE ANALYSES
1801 North Beauregard Street
Alexandria, Virginia 22311-1772

Dear Mr. Devers:

I am forwarding the final version of our comments on your Review Version of IDA Paper P-2863, A COMPARISON OF AIR FORCE DATA SYSTEMS, JUNE 1993.

Because of the extremely short time which we were allowed to review and comment on this report, the attached response does not necessarily include all of the comments which we might have made, given sufficient time.

We would like very much to continue our review and provide you with additional comments and, further support and clarification for comments being provided at this time, which may be helpful to you as you prepare to present the final version to the U.S. Congress.

Sincerely,

LITTON COMPUTER SERVICES

Thomas F. King,
REMIS Program Director

TFK/jd
TFK93.023

B. COMMENTS

LCS Comments:

A copy of the comments from LCS appears on pages IV-9 through IV-41 of this document. Copies of the various attachments referred to in the comments appear as follows: Attachment 1 begins on page IV-43; Attachment 2, on page IV-45; Attachment 3 is on page IV-65; Attachment 4 begins on page IV-67; Attachment 5 is on page IV-69; Attachment 6 is on page IV-71; Attachment 7 begins on page IV-73; Attachment 8 begins on page IV-81; and Attachment 9 is on page IV-85. The page numbers in both the LCS comments and the IDA responses that follow refer to page numbers in the review version of IDA Paper P-2863.

IDA Response:

1. Page I-1 and I-2: We acknowledge the comment regarding the GAO. We believe that the text presents accurately the rationale for the study. The base-level studies of CAMS are described in the GAO report. The results of the Operational Assessment of EIMSURS and PPS are not yet available, and we have noted that in the report.
2. Page II-1, Para A.1: Chapter II has been revised and presents only brief descriptions of the systems. More detail on each system has been included in Chapter V.
3. Page II-1, Para A.1, Page II-6, Para B.1, Page II-9, Para C.1: Again, Chapter II has been revised to give brief descriptions of the systems, and details about the systems have been included in Chapter V.
4. Page II-2, Bullet 3: This issue is treated more fully in Chapter V.
5. Page II-3, Para 2, 2nd Subpara: Lines of code can indeed be a misleading measure of the size of a system. We have included REMIS lines of code in the report and re-examined our analysis of this issue.
6. Page II-2 and II-3: The CAMS ATERS function has been covered as part of the scope in the report. PQDR has been treated more fully in Chapter V.
7. Page II-4, Para A.3.b, Page II-8, Para B.3.b, and Page II-12, Para C.3.b: Coverage of these issues have been removed from Chapter II. They are treated more fully in Chapter V.
8. Page II-5, Para 3: We agree, and the report has been modified to reflect this information.
9. Page II-6, Para B.1, 1st Subpara: REMIS functions have been treated more fully in Chapter V. It is not yet fully operational.

10. Page II-6, Para B.1, 3rd Subpara: REMIS functions have been treated more fully in Chapter V.

11. Page II-7, Para B.1: Chapter V has been modified to provide a more detailed explanation of these systems.

12. Page II-7, Para B.1: A more complete description of PPS is contained in Chapter V. IDA was not able to confirm the bad actor identification or serial number tracking capabilities of REMIS.

13. Page II-8 and II-9, Para 3.B and 3.C: We acknowledge the comment. That material has been removed from Chapter II, and user concerns are dealt with in Chapter V.

14. Page II-9, Second Bullet, Top of Page: The material has been removed from the chapter.

15. Page II-9, Para C.1: We agree, and the report has been modified to reflect this information.

16. Page II-10, Para C.1: We agree, and the information has been deleted.

17. Page II-10, Para 3, Last sentence: We agree, and the information has been deleted.

18. Page II-11, Para C.2: Parts of SDS have been incorporated into TICARRS 92 (AMOC).

19. Page II-12, Para B: This material has been deleted from Chapter II.

20. Page II-12, Para C: Information from DRC was used as a starting point to arrive at independent IDA estimates.

21. Page II-12, Para II.C.3.b: The discussion of perceived problems has been removed from Chapter II.

22. Page IV-2, Para IV.B.2: We did visit the F-117A program office, and we received input from the F-117A community during our visit to Holloman AFB.

23. Page V-3, Table V-1: For reporting purposes, we believe that inventory possession and assignment can be combined. We have changed the text to reflect narrative information that was available. Bad actor identification by WUC is not sufficient. Bad actors are part/serial numbers. The table and text have been revised to include cannibalization and TCTO status for PPS.

24. Page V-3, Table V-1, a: The equipment issue was addressed in the previous comment. TICARRS requirements for these functions have been addressed in software changes and costs. The other issues here are a matter of scope, which has been addressed and estimated for TICARRS.

25. Page V-3, Table V-1, b: This issue has been covered in the discussion of scope requirements for TICARRS.

26. Page V-3, Table V-1, c: We agree, and the report has been modified to reflect this information.

27. Page V-3 Table V-1, f: This capability was not demonstrated to IDA.

28. Page V-3 Table V-1, g: PQDRs are treated in the text, but the table presents information at a more general level. The REMIS PMO was not able to supply IDA with data we requested that would have demonstrated serialized part maintenance history.

29. Page V-4, Table V-1, j: The report has been modified to reflect this information.

30. Page V-4, Table V-1, l: GCSAS has not been fielded yet; it is still in testing. The text of the report has been revised to elaborate on this point.

31. Page V-5, Para a: The report has been modified to reflect this information.

32. Page V-5, Para A.3.a: The report has been modified to reflect this information. The IDA team observed serious problems with possession change information at Langley AFB.

33. Page V-5 & V-6, Para b: ATERS has been noted in the report.

34. Page V-6, Para A.3.b: The report has been modified to reflect this information.

35. Page V-6, Para A.3.c: The report has been modified to reflect this information.

36. Page V-6, Sentences 1 and 2: The report has been modified to reflect this information.

37. Page V-6, Para 2, Last sentence: The report has been modified to reflect this information.

38. Page V-6, Para c: The report has been modified to reflect this information. TICARRS's limitations are addressed in the discussion of scope. We have made some changes to the report based on independent IDA findings.

39. Page V-7, Para A.3.f: Retrieval of narratives was not demonstrated to IDA.

40. Page V-9, Para A.3.g: The report has been modified to reflect this information.

41. Page V-9, Para 1: We disagree. A review of screens and conversations with Plans and Scheduling personnel at the squadron-level at Seymour Johnson AFB confirm IDA statements.

42. Page V-9, Para 3: The report has been modified to reflect this information. Concerning the statement about B-1 contractor: Rockwell engineers who focus on R&M analyses have not to date been successful in using REMIS. They rely upon information provided to them from site representatives at the B-1 bases. However, the report has been slightly modified.

    We disagree with Litton's comment about contractor needs. Contractors require historical data from D056 tapes, which are not available in REMIS (the tapes can

be obtained from the REMIS office, but the data have not been loaded into REMIS). REMIS has recent data only.

43. Page V-12, Para 2: We agree.

44. Page V-13, Para 2: Block number tracking in REMIS has not been demonstrated. Our impression, based on discussions with users, is that block number tracking is used for more than just TCTOs. It is also needed to track R&M status by block and to track warranty items.

45. Page V-14, Para p: TICARRS 92 combines TICARRS 87 and SDS.

46. Page V-16, Para B: Scope refers to breadth and depth of coverage, not to the functions, ease of use, and other areas of concern raised here. The costs of the functions mentioned in this comment have been estimated and are presented in Chapter VII of the report.

47. Page V-17, Para B, Last Subpara: Given the low usage levels of REMIS and the results of our own observations, we believe the text is appropriate. The importance of narratives is addressed elsewhere in Chapter V.

48. Page V-21, Para 1: We disagree.

49. Page V-22, Para 1: We have revised the text to make our sizing consistent.

50. Page V-22 and V-23, Para 2: Noted. We stand by our estimate.

51. Page V-23, Table V-3: Noted. We stand by our analysis.

52. Page V-23, Para 1: We believe that we are correct in using the official projections of usage. Utilization of a fully-operational, working REMIS system should be several times greater than existing levels.

53. Page V-25, Para 2 and Figure V-3: Noted.

54. Page V-29, Para c: We agree and have modified the report to reflect this information.

55. Page V-32, Para C.1.c.(3` 2nd Subpara: Noted.

56. Page V-32, Para 4: The report has been modified to reflect this information.

57. Page V-33, Para C.1.d: Noted.

58. Page V-36, Para C.1.f: Noted. We stand by our hardware sizing estimate.

59. Page V-36, Para F, 2nd Subpara: Noted. We stand by our hardware sizing estimate, and we have included additional detail in the report justifying it.

60. Page V-36, Para C.1.f, 3rd Subpara: Noted.

61. Page V-37, Para 1: We have modified our discussion of this issue to clarify it.

62. Page V-37, Para 2: Noted.

63. Page V-38, Para A: See our responses to the referenced comments (notes 1–3, 14, and 15).

64. Page V-38, Para a, "REMISTALK has poor training": While training may have received good ratings in the course critiques, opinions of the effectiveness of training may change weeks after the class, as trainees try to implement what they have learned in the field.

65. Page V-38, Para C.2.a: It is true that only ACC was surveyed in our study. However, USAFE and PACAF are heavy TICARRS users. The text has been altered to address this comment.

66. Page V-39, Para A: We have not discounted student ratings on REMIS training. Our information is that contractors are having trouble accessing and using REMIS, and they have told us that they thought training was not adequate. Training goes beyond formal classroom training and includes on-line support during normal use periods.

67. Page V-39: The IDA study team found no contractor—Rockwell, Lockheed Georgia, Lockheed-Fort Worth, or McDonnell-Douglas—who preferred using on-line REMIS to receiving D056 tapes.

68. Page V-45, Para D: The report has been modified to include this comment. However, our intent was to note the preference of TICARRS over REMIS by those who had used or were familiar with both systems.

69. Page V-46, Para D.1: This potential capability may improve the situation, but it has not been demonstrated.

70. Page V-47, Para 2: We agree and have modified the report to reflect this information.

71. Page V-52: We agree. CAMS has proposed a similar system.

72. Page V-52, 2nd Subpara and Figure V-8: Noted.

73. Page V-54, Para D.3: We have revised the security discussion significantly.

74. Page V-64, Para E.2: We have revised the discussion to clarify the specific advantages and disadvantages of the current systems in migrating to the future.

75. Page VII-3, First Paragraph: We have revised this entire analysis based on additional information provided by the Standard Systems Center.

76. Page VII-4, Table VII-1: We agree and have modified the report to reflect this information.

77. Page VII-4 and VII-32: The timing of regional processing center costs has been addressed with our new method of analysis. On the issue of modifications, we agree, and we have assumed that CSRDs would continue. The cost for base representatives has been addressed with our new method.

78. Page VII-4 and VII-6, System Integration Test: The costs are different because CAMS has an additional integration to perform—CAMS with other SBLC applications—and TICARRS does not use the SBLC.

79. Page VII-5, Approved Functional Modifications: The costs represent the effort to finish the backlog of approved CSRDs.

80. Page VII-6: We agree and have modified the report to reflect this information.

81. Page VII-6 (CAMS Extensions and New Weapon Support): We agree and have modified the report to reflect this information.

82. Page VII-7, Para 2E: We agree and have modified the report to reflect this information.

83. Page VII-10, Table VII-2, 1.2, and VII-11, Para 4.b: We disagree and have made independent estimates.

84. Page VII-13, Para B and C: We agree and have modified the report to reflect this information.

85. Page VII-16: We agree with the comment on the TICARRS MAISRC requirement. We assumed 8 months for TICARRS functional enhancements. The comment may have been prompted by confusion of what we mean by scope. In the report, scope is the number of weapon systems supported. We have allowed 29 months for expanding scope and loading data.

86. Page VII-17, Table VII-4:

    Adjustment to TICARRS Non-recurring Hardware Costs—We agree and have modified the report to reflect this information.

    Hardware Purchases—We assumed that TICARRS would have to purchase new equipment to completely support expansion.

    Training: We believe that trainee costs should be excluded, just as the cost of people using the system are. In any event, we believe the Litton estimates are too high, since each user is trained for 2 to 4 hours, not three weeks. We have not included student time in the estimates for any system.

    Adjustment to Hardware and Software Maintenance Costs—We stand by our estimate of the number of computers required for TICARRS.

    Civilian and Military Personnel—We agree and have modified the report to reflect this information.

87. Page VII-18 and VII-19, Mainframe sizing for TICARRS: We disagree. The CAMS transactions cited were for a single shift, versus a full day of TICARRS transactions. The assumptions underlying the Litton analysis are incorrect.

88. Page VII-21: We agree, and we have included these costs in our estimate.

89. Page VII-21, Table VII-5:

Communications-electronics—These enhancements have been included under data base initialization for $1.7 million.

Supply System—We disagree. We have included the cost of the SBLC interface.

FDWWs and DIREPs identified at the Seymour Johnson Operational Assessment—These have been included in our costs.

Costs for loading REMIS data into TICARRS—We agree and have modified the report to reflect this information.

TICARRS Hardware Costs—We stand by our estimate.

Initialization Costs for Trainers and ATE Equipment—We agree and have modified the report to reflect this information.

Lines of Code—We disagree, and we have included additional detail on lines of code in the final report.

90. System Software Interfaces: Our TICARRS cost estimate includes 0.75 staff-years *per* interface, even more than the Litton estimate.

91. Page VII-23, Para D: Our estimate of 10 percent of application software includes user documentation only. We have revised the report to include costs of applying the DoD standards.

92. Page VII-24: We agree and have modified the report to reflect this information.

93. Page VII-24, Table VII-6: We agree and have added these systems to our list.

94. Page VII-27, Para 3: We disagree and have not considered trainee cost for any system.

95. Comment on additional alternatives: Our task was to do a cost and operational comparison of CAMS/REMIS and TICARRS, and we have analyzed only the alternatives necessary to do this.

PAGE I-1 AND I-2

The report specifies that the GAO found serious problems with REMIS software. Do the difficulties affect the overall capability of the REMIS to support the over two-thousand major end items? These comments may refer to the "data accuracy" issue that has been raised in the past. Please see Attachment 1, T. King letter to Mr. Dave Roberts, dated February 3, 1993 on this subject.

No reference to the recent Operational Assessment of REMIS subsystems (EIMSURS and PPS) has been included. Aren't Operational Assessment findings appropriate for the study effort? We think so.

Several base level studies of CAMS are referenced, but no specific identification of these studies is provided.

PAGE II-1 PARA A.1

The report states that the major functions of CAMS are listed, but a large number of the major functions are missing, including: Utilization Reporting, C-E Subsystem, Trainer Subsystem, ATE Subsystem, Configuration Management, etc.

The report goes into great detail as to what functions TICARRS provides, for example, Page II-10 2nd paragraph lists: abort analysis, aircraft status and utilization measurement and analysis, flight scheduling, pilot debriefing, etc... While these same functions are provided in CAMS/REMIS, little, or no mention is made of that fact.

Litton would be happy to provide a complete listing of functions provided by the CAMS/REMIS system.

For a listing of functions that TICARRS does not provide see Attachment 2.

PAGE II-1 PARA A.1 PAGE II-6 PARA B.1 PAGE II-9 PARA C.1

The system descriptions contained in the referenced paragraphs do not compare the systems at the same level. The introductory sentences are not of a similar nature. CAMS is introduced by the phrase: "...major functions provided". REMIS is introduced by the phrase: "...these subsystems are briefly described", and TICARRS is introduced by the phrase: "...Its key features are...".

For a valid comparison to occur, the systems must be described in like manner, by function, by subsystem or by key feature. Most of the "key features" listed for TICARRS are also

capabilities of CAMS/REMIS, but the report does not point this out.

The description of TICARRS lists organizations with access to the system, but no list is provided for CAMS/REMIS. The CAMS/REMIS list is more extensive and also includes other automated data systems. Attachment 3 shows the 2518 REMIS users as of July 1, 1993. All 28 organizations shown on this chart presently have access to REMIS, while only 8 of them have access to TICARRS:

	ACCESS TO SYSTEM	
ORGANIZATION	CAMS/REMIS	TICARRS
AFMC	YES	YES*
AECC	YES	NO
AFSOC	YES	NO
PACAF	YES	YES
ATC	YES	NO
AMC	YES	NO
AFIC	YES	NO
CONTR	YES	YES
AF RESERVES	YES	YES
ANG	YES	YES
ACC	YES	YES
USAF	YES	YES
SPACECOM	YES	NO
USAFE	YES	YES
AF ACADEMY	YES	NO
AF SAFETY AGENCY	YES	NO
AFIT	YES	NO
CENTRAL COMMAND	YES	NO
AF COST ANAL AGENCY	YES	NO
AFOTEC	YES	NO
NAT WEATHER SERVICE	YES	NO
AUDIT AGENCY	YES	NO
ACCOUNTING & FINANCE	YES	NO
AF HISTORICAL RES CTR	YES	NO
NAVY	YES	NO
OSD	YES	NO
DLA	YES	NO
SAF	YES	NO

*ONLY OGDEN ALC HAS ACCESS

PAGE II-2 BULLET 3

This statement seems to imply that CAMS only updates CEMS and is misleading. The system provides single terminal input to the CAMS data base and also interfaces with CEMS (D042) via a daily tape. The CAMS users are able to control inventory, status, utilization, and configuration of all engines and components at their home station, as well as when they are deployed.

PAGE II-3 PARA 2 2ND SUB PARA

The reference to the size of CAMS specifies: "1.1 million unique Source Lines of Code (SLOC)." The reference to the size of TICARRS specifies: "The application software is in COBOL 74 (approximately 850 thousand lines of code)." No software sizing data for REMIS is provided. This does not appear to be a valid comparison.

PAGE II-2 and II-3

The following should be included as additional functions added to CAMS over the period 1985-1992:

1) Automatic Test Equipment Reporting System (ATERS). This subsystem provides on-line access to a data base containing organization, equipment, status, and utilization data for assigned test equipment. It also keeps track of the capability of various test stations to test particular parts. This permits the Avionics Intermediate Shop (AIS) to update the appropriate data in the data base in an on-line mode as events occur which affect assigned test equipment.

2) Product Quality Deficiency Reporting (PQDR) Subsystem. The PQDR Subsystem reports known or suspected deficiencies for equipment, weapon systems, or related components and records exhibit disposition instructions and data. This subsystem has an interface to INFOCEN that allows approved PQDRs to be transmitted directly to INFOCEN via CAMS.

PAGE II-4 PARA A.3.b PAGE II-8 PARA B.3.b, and PAGE II-12 PARA C.3.b

The "Perceived Problems" descriptions contained in the referenced paragraphs do not describe the system problems at the same level. The introductory sentences are not of a similar nature. CAMS is introduced as: "CAMS has been accused by some of its users of a wide variety of deficiencies.", REMIS is introduced as: "Several issues that affect the satisfactory operation of REMIS are: ", and TICARRS is introduced as: "A number of existing Air Force functions are not provided in the current version of TICARRS."

For a valid comparison, the perceived problems should be described in like manner, by user-voiced deficiencies, operational issues, or by missing Air Force functions. It is not clear whether or not the "deficiencies" in CAMS are in the areas where TICARRS is totally missing the function. If so, there is no reason to assume that a TICARRS implementation of the function would not have the same deficiency. No mention of operational considerations for TICARRS is included. Since so many critical functions are missing from TICARRS, the development effort required to add them will almost certainly cause operational concerns similar to those perceived for REMIS, especially in the area of performance.

PAGE II-5 PARA 3

There appears to be confusion with regard to the roles of the Data Base Administrator (DBA) and the Data Base Manager (DBM). The functions of the DBA and the DBM are decidedly different but the report doesn't appear to recognize the differences.

PAGE II-6 PARA B.1 1ST SUBPARA

First sentence states that REMIS: ". . . is meant to serve as a centralized source of fleet-wide weapon system configuration and historical maintenance data for all Air Force weapon systems and support equipment."

REMIS does serve as a centralized data source; this is not a future capability (as inferred by the phrase: ". . . meant to be . . .".

Fleet-wide weapon system configuration and historical maintenance data are only two of the major functions of REMIS. The list should include Inventory Control through maintaining the Air Force Master Inventory, Inventory Assignment, and Inventory Possession: weapon system status, both current and historical, for aircraft, missiles, trainers, automated test equipment, communication - electronics equipment, and utilization information such as actual and allocated flying hours, actual sorties, landings, and full stop landings.

PAGE II-6 PARA B.1 3RD SUBPARA

The list of functions REMIS is to provide, "when fully operational", has been provided and is currently available. The functions listed provide the framework that specific application software must function within. Some of the functions of a similar nature which have not been, and should be, included are:

- Open communication support architecture
- Data compatibility edits
- Data completeness edits
- Data reconciliation
- Air Force standard algorithms
- 1 year of detail data and 5 years of summary data on-line
- Archival and Retrieval of detail data
- Integrated report capabilities across weapon systems
- Data types and geographic location for user specified subject, time span, and other relevant criteria for both detail and summary data
- World-wide Electronic Mail
- Controlled user access by read, add, change and delete
- On-line edits as a feedback mechanism to people entering data in order to facilitate detailed and accurate reporting. Up to 10 error conditions may be identified for each transaction attempt.
- On-line help screens for all applications as well as on-line system level help
- System to system interfaces
- Inbound and outbound data transfers
- Etc.

PAGE II-7, PARA B1

The EIMSURS subsystem also provides: data reconciliation; many Master Validation tables such as Work Unit Code; Command Code; Allowable Condition Status Code; 65-110 Organization Number; Kind and Type; Type Utilization Code/Mission Symbol, etc.; pushdown of the centrally maintained edit and validation tables to CAMS bases worldwide; input interfaces with systems such as AICARRS (G081) for inventory, status, and utilization and Air Staff (K002) for allocated flying hours; output interfaces with systems such as D087F, D160, D200, G086A, G075, K008, K002 and contractors to provide inventory, status, and utilization information in a format customized to meet the needs of the receiving system.

The EIMSURS subsystem also provides information to the other

REMIS subsystems since flying hours and sorties are needed to calculate many of the R&M predictors such as Mean Time Between Failure (MTBF) or Mean Time Between Maintenance Manhour (MTBMMH).

REMIS EIMSURS receives hourly updates from base level users for inventory possession, status, and utilization; EIMSURS also provides on-line entry of this data. Both current and historical status information is available fleet-wide in REMIS. Authorized users may ask REMIS to provide information such as the current Air Force wide Mission Capability Rate for all F-15 aircraft or for any combination of MDS, organization, location, purpose code, command code, etc.

EIMSURS is the only automated system which supports full aircraft assignment functions at both the command and organizational levels.

A majority of these functions are not in the current TICARRS, and costs associated with enhancing TICARRS to include these functions are not addressed in Paragraph VII.C.

PAGE II-7, PARA. B1

The description of the PPS subsystem is not complete when compared to the description of the same function in TICARRS. Some of the missing functionality includes:

- Discrepancy and Corrective Action Narratives
- Data compatibility and completeness edits
- Bad actor identification
- Reporting of repeat or recurring problems with particular Work Unit Codes
- Cannot duplicate/re-test OK analysis
- Serial number tracking
- Fault isolation/analysis/resolution by providing failure typing (inherent, induced, no defect)
- Not-Repairable-This-Station (NRTS) analysis

PAGE II-8 AND II-9 PARA 3.B AND 3.C

LCS has a system performance team in place to analyze and address all issues pertaining to system performance. This team is developing plans and schedules to repartition data stored in the REMIS data base tables, reallocation of disk space, and implementation of the Operating System's parallel processing capability to its fullest extent. This team has also developed many recommendations for changes in application software to improve processing speed. It is anticipated that these changes will be implemented by the PMO as resources become available. Also under consideration are plans for a

partial reconfiguration of \HQ1 and \HQ2 hardware and movement of REMISTALK from \HQ1 to \HQ2.

The scope of REMISTALK is regularly increased to meet additional user requirements. This is being accomplished via creation of additional Reportable Data Base Areas (RDAs) or the addition of tables to the current RDAs. This effort does not require software enhancement, just the description of data elements and tables and loading of information concerning these RDAs to the REMIS data base.

The implementation of a REMIS information center data base utilizing the current development hardware (Tandem CLX) at FOC will resolve the scope and response time issue for ad hoc and standard reports. Movement of these activities to the CLX will free-up resources on \HQ1 and \HQ2 to meet additional user requirements and greatly enhance system performance.

PAGE II-9 SECOND BULLET TOP OF PAGE

The report states that, "Contractors have had difficulty getting access to REMIS due to imposed security steps". This statement is incorrect. The Air Force policy for security has not yet been defined and, until it is, the Contractors are expected to complain about any system whether it is CAMS/REMIS, TICARRS, or any other.

PAGE II-9 PARA C1

This paragraph is in error and conflicts with other portions of the report. It states that TICARRS provides a "deployable system". Other portions of the study clearly state that TICARRS does not provide a deployable system. See Pages V-4, Table V-1, and Page V-15, "neither CAMS nor TICARRS is able to support such deployments today".

Most significantly, costs were added to CAMS to develop this capability (Page VII-6, Paragraph 1b, CAMS Extensions and New Weapon Support) in CAMS. However, similar costs were not added to the TICARRS cost estimates (see Pages VII-19 and 20, Paragraph 2b.) Since neither system has the deployable capability, the costs to develop it should be added to both CAMS and TICARRS to portray valid cost comparisons. In addition, no hardware costs were included for a deployable system. Both new software and hardware will be needed.

The Air Force has, on a number of occasions, evaluated Major Command and agency requirements for a deployable maintenance data collection system. These reviews have taken place at least each year since 1984, and to date, no clear cut

requirement has been established for a deployable system.

The latest review process is underway at this time. Air Combat Command (ACC) is now taking the lead in accumulating all requirements of a deployable CAMS system, in order to establish a firm requirement which will be presented to the CAMS/REMIS Functional Review Board members at their next meeting. ACC then intends to modify the current Functional Description and furnish the document to Hq USAF for disposition. The point of this discussion is that the Air Force has not yet established a firm requirement for a deployable CAMS system; therefore, the statement made by the IDA evaluation team appears to lack a proper foundation. Until the requirements are known, no systems should be recommended or selected over another.

Litton Computer Services (LCS), among others, has recommended a development concept for a Deployable CAMS (DCAMS) system. Litton's concept takes advantage of existing CAMS code, resident on the UNISYS 1100, by transporting the COBOL code from the mainframe platform to a personal computer (PC) environment. At project completion, the system would contain a relational data base, using open systems operations. The key to the LCS concept is, the end user view of input screens and output reports remains exactly the same in the PC version as in the mainframe version. Thus, no end user training is required to operate the PC version of CAMS, since the code on the PC version operates exactly as the mainframe would. This is extremely important to both management and the users, since no change in operations is required when a unit deploys. The user should not be required to operate two different systems (one at home station and another at a deployed site). LCS has made its views known to many key decision makers in the Air Force, and our concept has been generally accepted.

The Dynamics Research Corporation (DRC) model of a deployable system, called Squadron Centered Logistics System (SCLS), has vastly different input and output views from that of CAMS. Most units deploy on a limited basis (2-3 times per year). Providing the end user a different "deployed" system, one which is different from the norm (CAMS), will probably result in confusion and set the stage for errors in data collection, and the loss of data. In turn, when returning from the deployed site, confusion, errors, and data loss may occur until additional retraining takes place.

The fact that Air Force requirements for a deployable systems have not yet been firmly established, and the observation that TICARRS would be suitable for a deployable system are in conflict with each other.

PAGE II-10 PARA C.1

References to "RAM for the F-117A, and INS" do not seem appropriate. These are not currently TICARRS supported functions.

PAGE II-10 PARA 3 LAST SENTENCE

Warranty tracking is available for F-15 by query only. TICARRS provides no notification of warranty parameters. The F-16 users must query the data base by inputting part numbers the user knows are under warranty.

PAGE II-11 PARA C.2

Reference to SDS and F-117A are not appropriate since SDS is not a part of TICARRS and the F-117A's are now fully supported by CAMS and have been since they became unclassified.

PAGE II-12 PARA B

The problems cited in the TICARRS 92 test are not a matter of perception but real problems. Please refer to General Hammond's letter to Senator Inouye, dated May 24, 1992, Attachment 4.

The statement, "Many aircraft types supported by CAMS/REMIS are not now being supported by TICARRS" is misleading. Please see Attachment 1 which shows the items supported by CAMS/REMIS and TICARRS:

ITEM	CAMS/REMIS	TICARRS
• Aircraft	10,555	2,800
• Missiles	4,395	None
• Communications Electronics	1,054,000	None
• Aerospace Ground Equipment (including Automated Test Equipment)	60,000	500
• Simulators & Trainers	1,081	None

PAGE II-12 PARA C

DRC's analysis of what work would need to be performed to upgrade TICARRS does not seem to be the best, unbiased source for this information.

PAGE II-12 PARA II.C.3.b

Describing TICARRS "perceived problems" in the terms of Air Force functions does not address shortcomings within the limited functions that do exist. Some shortcomings that should be addressed include:

- Data completeness: no interface exists for TICARRS to receive information on PMEL; the ATE functions within TICARRS do not address all ATE equipment; failure data on parts utilized in more than the F016 and F015E weapon systems is incomplete due to the lack of visibility of the other weapon systems, etc.

- Data accuracy: TICARRS does not have an interface with D043 and, therefore, does not have an Air Force approved part number master; this permits inaccurate data to enter the system.

- Operational considerations, such as the frequency and number of PLP (ad hoc) report requests are not captured. This prevents the standardization and optimization of ad hoc reports; base level users are required to perform dual inputs since TICARRS cannot meet all of the users basic needs.

- Communication to provide users access to TICARRS is based upon dedicated leased lines. If the TICARRS user community was expanded to be equivalent to that of CAMS/REMIS, the number of lines would also have to be expanded. CAMS/REMIS employs a much more cost effective methodology to achieve user connectivity.

- TICARRS is based upon a Network data base structure. This type of data base does not support accurate modeling of the complex relationships that exist between R&M information. REMIS is based upon a relational data base structure and more accurately represents R&M information. Maintenance costs for major upgrades to Network data base systems are generally higher than those for relational.

- See also Attachment 2.

Major functions provided by CAMS/REMIS but not addressed include:

- Allocated flying hours.
- Current status for Aircraft, Missiles, Trainers, and Communication-Electronics.
- Inventory Assignment for Aircraft at both the command and organizational level including information such as assignment directive, and geographic location.

- Support for aircraft other than F-16 and F-15E. This is major since most other aircraft do not manage by block number, some use configuration identifiers.
- User Maintainable Validation tables such as Standard Reporting Designators (SRD).
- Air Force standard algorithms. Those utilized by the F016 and F015E community are not necessarily acceptable to the Air Force R&M community as a whole.
- Multiple Status for Communication-Electronics equipment.
- Maintenance of TCTO Master information.

The majority of these functions do not exist in the current TICARRS and are not addressed in either Paragraph VI.C, Areas of Enhancement for TICARRS, or Paragraph VII.C, Cost Estimates for TICARRS.

PAGE IV-2 PARA IV.B.2

Shouldn't the list of activities include the F-117A program office? F-117A personnel have had the opportunity to utilize SDS and to utilize CAMS/REMIS. The Air Force chose CAMS/REMIS for the F-117A.

PAGE V-3 TABLE V-1

Inventory Possession and Inventory Assignment should not be lumped together; they are two separate functions. REMIS does receive narrative data on debriefing failure history and corrective actions under DDN.

REMIS does contain serialized part maintenance history and provide bad actor identification by WUC.

REMIS, under PPS, tracks and outputs all cannibalization actions.

TCTO status has been received from CAMS since PPS implementation.

PAGE V-3 TABLE V-1,a

- Equipment Inventory - Assignment and Possession are separate and discreet functions and should not be combined. REMIS supports full assignment capability for command and organizational levels and includes both current and historical information for all aircraft. TICARRS does not support this function. The costs associated with adding this function to TICARRS are not included in Paragraph VII.C.

- REMIS maintains both current and historical inventory possession information for aircraft, missiles, trainers, automated test equipment, and communication-electronics equipment. TICARRS does not.

- REMIS maintains the Air Force Master Inventory including information such as acceptance date, lot number, block number, configuration identifier for all aircraft types, missiles, trainers, AGE, ATE, C-E, PMEL, Munitions, and Parts. TICARRS does not.

PAGE V-3 TABLE V-1,b

CAMS/REMIS supports Multiple Status for C-E and all ATE equipment. TICARRS does not.

PAGE V-3 TABLE V-1,c

REMIS provides the capability to compare actual flying hours to Air Staff allocated flying hours. TICARRS does not have allocated flying hours.

REMIS supports Air Staff by providing actual flying hours, sortie, and landing data by Mission Symbol by Program Element code for each possessed aircraft. TICARRS does not have utilization data by Program Element Code (an Air Staff requirement) and does not support an interface with Air Staff.

PAGE V-3 TABLE V-1,f

The table is incorrect. REMIS does maintain debriefing discrepancy narratives.

PAGE V-3 TABLE V-1,g

An important aspect of Maintenance Scheduling/Reporting is Product Quality Deficiency Reports (PQDRs). This function is missing from the table and should be included. CAMS/REMIS supports this function, TICARRS does not.

REMIS supports: job tracking, Failure Histories, including narratives, Serialized Part Maintenance History, and "Bad Actor" Identification. The table should be corrected.

PAGE V-4 TABLE V-1,j

REMIS does support cannibalization tracking.

PAGE V-4 TABLE V-1,l

TCTO Management consists of two major functions: TCTO Master information and TCTO status. The REMIS GCSAS supports both of

these functions. TICARRS does not; only TCTO status is supported by TICARRS.

PAGE V-5 PARA a

CAMS only provides command of assignment. TICARRS does not provide all assignment data as this involves AVDO input. REMIS also provides for direct input of inventory possession and assignment data. REMIS provides the function of "shifting" data.

REMIS has been keeping Inventory Possession information since EIMSURS was fielded in 1990. REMIS has and will continue to "keep up" with possession changes. Reconciliation of CAMS and REMIS has been completed for RECFU II.

PAGE V-5 PARA A.3.a

The report specifies CAMS and TICARRS have the capability for direct entry of equipment identification, etc. REMIS supports on-line entry of inventory information and provides on-line feedback to promote data accuracy. REMIS maintains both current and historical inventory, inventory assignment and inventory possession information. Air Staff is also a primary user of REMIS inventory data. TICARRS does not support Air Staff in this manner.

The report states that "REMIS does not keep up with possession changes". REMIS does not have a throughput problem with CAMS EIMSURS data.

PAGE V-5 & V-6 PARA b

Status for ATE has been available in CAMS since its predecessor (MMICS) enabled the function in 1980. It has not received wide spread use because it was intended for use by F-15 and F-16 back shops which continue to use TICARRS. NOTE: The CAMS ATE functions are based on the ATE functions in TICARRS.

PAGE V-6 PARA A.3.b

The report states that edits pushed back to the originator for verification or correction are simply dropped after an interval of time whether or not the verification or correction has been done. This is not true. The original version of RECFU II fielded in 1992 did have an expiration period for returned transactions; however, the currently fielded version does not delete expired transactions. All transactions remain on-line until corrected by the originator.

PAGE V-6 PARA A.3.c

Not only are the MAJCOMS primary users, but so is the Air Staff. TICARRS does not provide utilization information to the Air Staff. Accurate utilization information is extremely important since Major Command budgets are based upon actual flight hours. Air Force personnel must determine if the TICARRS utilization function requires complete redesign or if it can be corrected to report accurate utilization information. The cost for this determination and any cost associated with correcting deficiencies is not included in Paragraph VII.C.

REMIS accepts allocated flying hour data from Air Staff and provides reports comparing allocated vs. actual flying hour data. This report (K002) is one of the most important outputs of CAMS/REMIS. TICARRS does not support this function.

PAGE V-6 Sentences 1 and 2

CAMS has a subsystem to track the status of ATE. It is called ATERS. The statement that "this CAMS subfunction is not available in CAMS" is incorrect.

PAGE V-6 PARA 2 Last sentence

This sentence is incorrect. Errors pushed back to CAMS from REMIS for correction are not dropped after an interval of time.

PAGE V-6 PARA c

Second Sentence: "Touch-down landings". All landings are "touch-down". What is probably meant here is "touch and go landings".

The report lumps inventory, status and utilization functions into one pot, assuming that covers all equipment. TICARRS only provides these functions for aircraft and does not provide inventory possession for ATE, their genesis equipment. Inventory possession, status and utilization for trainers (flight simulators, mission simulators, etc.) are not covered in TICARRS and this type of reporting for C-E is so completely different from other equipment as to be a major function loss all by itself.

In the paragraph on utilization and the comments about accumulated flight hour problems, it would have been very easy to compare CAMS & TICARRS to see where the problems arose, since CAMS was maintained in its entirety during the OA. The plans and scheduling sections used CAMS during the OA to forecast time change requirements since TICARRS is unable to

perform this function.

The last paragraph on this page alludes to a problem ACC personnel have on reporting flying hours to Air Staff. This is misleading since the only source of flying hour reporting to the Air Staff is REMIS. Since flying hours are used for budgetary considerations, ACC makes certain that data in REMIS is accurate before the report goes to the Air Staff.

PAGE V-7 PARA A.3.f

REMIS does include Debriefing discrepancy narratives.

PAGE V-9 PARA A.3.g

REMIS currently receives both Discrepancy and Corrective Action narratives from CAMS. REMIS currently provides queries which display these narratives to REMIS users. REMIS users may also access these narratives through REMISTALK. The report discussion on narratives is incorrect.

PAGE V-9 PARA 1

The statement that CAMS does not automatically calculate TCI due dates and TICARRS does, is wrong. TICARRS does not and CAMS does. CAMS has been automatically calculating TCI due dates since its predecessor (MMICS) enabled this function in 1974. CAMS not only automatically calculates due dates, it also forecasts time change item due dates five years in advance, by quarter, which is a requirement of T.O. 00-20-9, a function TICARRS does not perform.

PAGE V-9 PARA 3

Two-level maintenance. The report indicates that all intermediate work will be performed at the depot. The concept is only envisioned for those LRU's that must be tested on Automatic Test Equipment (ATE); for those hundreds of items not requiring ATE support, the work will continue at the intermediate level.

A-10's use some of the same avionics LRU's as the F-16, but TICARRS cannot track them at either base level or depot level.

The statement about the B-1 contractor creating their own data base, rather than rely on REMIS, is inaccurate. The B-1 CSAS-CDB was created in 1985 (pre-REMIS) to track configuration data, not maintenance history data. REMIS GCSAS absorbs the functions of the B-1 CSAS and replaces it.

The statement that other contractors need the data in D056, because it is not available from REMIS, is incorrect. REMIS

has converted all On-Equipment information from D056 into REMIS and D056 currently receives the same data from CAMS that REMIS receives.

PAGE V-12 PARA 2

The report seems to reflect a lack of familiarity with part/serial number tracking. It is possible to have actual duplicates of part/serial numbers in the inventory. This does not cause a CAMS unit at base level a problem (CAMS does not allow duplicates in the same data base). This problem becomes more serious when a system deals with multiple types of aircraft (something TICARRS does not have a problem with, since they only deal with the F-15 and F-16 aircraft.)

GCSAS incorporates the CAGE (Contractor and Government Entity) in its configuration tracking order to alleviate the problem of duplicate part/serial numbers.

PAGE V-13 PARA 2

REMIS is currently developing block number tracking. While TCTO's for F-16's may be issued by block number, they are scheduled, completed and reported by individual aircraft serial number.

No other aircraft fleet manages by block number as F-16's do. All aircraft, including F-16's, have been managed in CAMS for several years without degrading performance or operations.

PAGE V-14 PARA p

TICARRS and SDS are not the same system. SDS was based on TICARRS, but there is currently no basis for comparison.

PAGE V-16 PARA B

The scope deficiencies of TICARRS are only partially addressed. Scope concerns such as: interfaces, master edit and validation tables, communication methods, such as FTP, SMTP, etc., transaction volumes, increased data relationships, increased user volume, increased data size, increased data compatibility, edit complexity, increased overall system complexity and its impact on user friendliness, increased training requirements, etc. are not addressed. Also not addressed is the impact of the additional functions on the existing TICARRS system. For example, most TICARRS reports require the user to enter EQUIPMENT TYPE, a two position field with the first position representing Series (e.g.: the E of an F015E) and the second position representing the first non-zero digit of block number (e.g.: 1 would be block 010). All TICARRS reports, utilizing the EQUIPMENT TYPE data element,

require modification if TICARRS is expanded to support other aircraft. This is true because Series is not unique across multiple Mission and Designs. Another example is TICARR's use of the term ORGID. Sometimes it represents geographic location indicator and other times it represents the 65-110 organization number. Organization number is not unique across commands. All TICARRS reports using shorthand data fields of this type require significant modification to operate if the scope is expanded. NOTE: The TICARRS data base has the same problem as the reports and will also need to be redesigned. The cost associated with these necessary modifications is not included in PARA VII.C.

PAGE V-17 PARA B Last SUBPARA

The report states, "REMIS has no inherent advantage over TICARRS". It goes on to state, "TICARRS currently contains important narrative information REMIS does not". REMIS gathers narrative information under DDN processing.

PAGE V-21 PARA 1

The performance data listed in Table V-2 for TICARRS, Table V-3 for REMIS and Table V-4 for CAMS does not use comparable topics. On report page V-20, the last sentence states, "The response time data presented in this report is limited to the central computer processing time for each transaction." However, this report penalizes the CAMS response time by including the data transmission communications delays.

Based on the number of transactions a TICARRS user must enter daily versus a CAMS user to accomplish one day's work, there is evidence that TICARRS transactions are smaller and simpler to process. TICARRS users must enter four transactions for every one entered by a CAMS user. In other words, the four transactions required by TICARRS at 3 seconds each means the TICARRS user will take 12 seconds to do what a CAMS user can do in 4.56 seconds (see first sentence on Page V-25).

For "...the second type of transaction (more complex and lengthy output)", the TICARRS transactions were not measured. Observations were accepted by the IDA study team. A recent review of standard TICARRS reports shows that they provide less functionality, scope, and complexity than similar REMIS report transactions. Additionally, the relatively small size of the TICARRS data base (22M records) <u>vis a vis</u> the REMIS data base (over 100M records) provides TICARRS a report processing response time advantage which would vanish if TICARRS attempted full CAMS/REMIS functionality and scope.

Furthermore, not only were no response time measurements taken for TICARRS standard reports, "...there were no measurements

of the number and/or throughput of standard reports" taken.

PAGE V-22 PARA 1

This section notes that: "TICARRS would need to be substantially increased (about 3 times more power) to maintain satisfactory response." However, Page VII-18 states that: "Computer power must be 4.4 times the existing level." A more accurate sizing of the CAMS/REMIS equivalent TICARRS computer is found under the comments for Page VII-18, Mainframe Sizing for TICARRS. That sizing shows that the TICARRS computer would need to be 18.66 times its existing size, not 4.4.

PAGE V-22 and V-23 PARA 2

While current measurements show that the \HQ1 CPUs are operating at 60% capacity, other resources including disk, I/O channel, interprocessor bus, and memory consumption are well below the 35% utilization range. Implementation of the system performance team's plans and recommendations will significantly improve system balancing. These activities will result in improvements in system performance and response time. In addition, 80% of operations functions and all of system test functions have been moved from \HQ1 to \HQ2.

System tuning continues to receive high priority and is accomplished daily. The NCC closely monitors CPU utilization and moves processes as required to achieve CPU balance. The system administrator analyzes system performance daily and applies tuning techniques when and wherever possible to improve performance.

PAGE V-23 TABLE V-3

The TICARRS performance data did not provide similar information to the REMIS performance data. A comparison based on dissimilar data is not valid. REMIS total transactions per day are not provided.

PAGE V-23 PARA 1

Given the historical number of standard and REMISTALK reports requested daily by REMIS users, the September 1992 projections of the number of reports anticipated is much too high. No noticeable upward trend is evident in the number of either type of report during the first six months of 1993. The only significant increase in users will occur when GCSAS becomes

fully operational, but those users alone are not expected to account for anywhere near a ten-fold increase in reports generated daily.

PAGE V-25 PARA 2 AND FIGURE V-3

The second paragraph on this page states, "While about 33% of the CAMS bases have average response times of 3 seconds or less, 67% have average response times of greater than 3 seconds." To state this same information another way, it is true that about 33% of the CAMS bases have average response times of 3 seconds or less, 62% of the bases have response times of 4 seconds or less, and 77% of the bases have 5 second or less response times. Since the software is the same for all bases, the difference is in the SBLC operation at some bases. As the report states on page V-37, "The move to Regional Processing Centers (RPC) will tend to improve operational control and discipline...".

PAGE V-29 PARA c

EIMSURS functions include utilization.

GCSAS functions include TCTO management.

PAGE V-32 PARA C.1.c(3) 2nd SUBPARA

The statement that the TICARRS data base is structured to cover the entire (world-wide) fleet of weapons systems similar to REMIS is incorrect. The implication that TICARRS current data base structure can support multiple Mission Design Series (MDS) for equipment other than F-16 and F-15E is misleading. TICARRS data base structure relies heavily on a field called EQUIPMENT TYPE which cannot be used across MDS where Series is not unique.

PAGE V-32 PARA 4

This paragraph states, "One of the most frequent complaints by CAMS users is the requirement to re-enter data when moving to a new screen in the same process. This occurs in TICARRS as well, but it does not seem to be as great a concern to users." If CAMS and TICARRS both have the same problem, why is it a problem for CAMS and not "as great a concern" for TICARRS?

PAGE V-33 PARA C.1.d

As the report points out, REMIS utilizes a prototyping methodology for requirement definition when designing large program components. Prototyping was utilized on GCSAS with a high degree of success. The report failed to address the

other requirement definition methods employed by REMIS. In determining requirements for the Communication-Electronics subfunction of EIMSURS, REMIS designers interacted directly with representatives of the C-E community from each of the Major Commands. This direct user involvement enabled REMIS to develop a design that not only met the user needs but also standardized C-E processing across the Air Force. REMIS selects the particular requirement definition approach to utilize depending upon the scope, complexity and nature of the project. The major factor included in all REMIS requirement definition approaches is direct user involvement.

PAGE V-36 PARA C.1.f

There is a wrong way to manage the activity, and that is the attempt to agree on requirements, which will become contractually binding by having tens of Contractor Field Representatives interface with perhaps hundreds of functional users. This has never been worked, never will, and always results in enormous contractual and financial problems.

The report estimates that the TICARRS computer system capacity will need to be 4 to 4.5 times more powerful. This estimate is severely understated. The report specifies the estimate is based on CAMS transaction volume. REMIS volume should also have been considered, especially in the area of interfaces and user reports. The additional functions TICARRS would be required to support increases the number of linking or relating data base records needed. With the increase in data maintained on-line, each report will be required to read through more information to develop the output. Therefore, each report will consume more system resources than it does currently. Increased transaction volume requires increased system resources dedicated to functions such as roll forward and roll back. When factors such as these, and those specified in comments addressing Page V-16, Paragraph B are considered, it becomes obvious that system size does not have a linear relationship with transaction volume and functions, but is exponential.

PAGE V-36 PARA F 2nd SUBPARA

In the second paragraph, the author makes the statement that, based on transaction volume, the TICARRS computer system would have to be 4 to 4.5 times more powerful. This is understated by a factor of 5. Transaction volume alone does not determine the size of a computer system, and the fact that CAMS supports 109 locations while TICARRS only supports 35, alone makes size a factor of 3. To suppose that adding in the additional functions of CAMS and the ability to handle all the thousands of additional equipment types, only increases workload by 1 to 1.5 is unrealistic.

PAGE V-36 PARA C.1.f 3rd SUBPARA

The topic is system technology and performance summary. The report addresses extending the REMIS standard and REMISTALK report capabilities to allow a broad scope of data. This recommendation is misplaced as it does not relate to system technology or performance. No mention of the limited TICARRS report scope is included and is as relevant as the REMIS report scope.

PAGE V-37 PARA 1

This paragraph contradicts itself. First, it says, "Where SBLC support is good, CAMS operation and availability is good." Then it states, when the move to the Regional Processing Centers is completed, "CAMS software reliability needs to be examined to ensure it is not the basis of availability problems."

PAGE V-37 PARA 2

CAMS receives all the same edit/validation tables that REMIS uses. CAMS does reject 99% of incorrect/invalid data when it is entered. CAMS must rely on REMIS to validate those comparative few transactions that require views of data for an entire MDS, that is, configuration data.

PAGE V-38 PARA A

See Comments for Pages II-1 and II-9 (Above).

PAGE V-38 PARA a "REMISTALK has poor training":

To date, REMISTALK training has trained 151 students. The students have consistently rated the instructor, course materials and overall course content above average to excellent on the REMISTALK critiques. Numerous comments have been provided by students citing the outstanding efforts of the instructor, the educational value of the course materials and the excellent course content and information flow. Students with NO prior experience have stated that they felt confident they could now easily layout and build REMISTALK reports. Extensive one-on-one training with each student is provided during these training sessions and students are provided with ample time and opportunity to layout/build REMISTALK reports tailored for their individual needs.

Attachment 5 is a copy of the critique form each student must complete upon graduation. If the students rated an area below 4 (3.5 is average), it is included in the category "other". You will find that 95% of the students consistently rated all

areas at a 4 or above.

PAGE V-38 PARA C.2.a

The report lists user criticisms of REMIS under the heading of MAJCOMS (ACC). ACC is only one MAJCOM. Were other MAJCOMs polled? Questionnaires should address specific system functions and not allow for ambiguous statements, such as: "REMIS is slow".

PAGE V-39 PARA A

The report states that,"REMIS has poor training".

Litton Computer Services (LCS) has developed and conducted three REMIS courses for the Air Force between 1987 and 1993:

REMIS EIMSURS End Users Course - E10SC4925-314
REMIS PPS End Users Course - E10SC4925-000
REMIS GCSAS End Users Co rse - E10SC4925-009

Each course was developed and approved per contractual requirements and sound training practices for adult learning. Air Training Command (ATC) approved each course prior to the course being presented by LCS to the REMIS end-users.

To date, REMIS End-User training has trained over 1,666 students. Numerous comments have been provided by students citing the outstanding efforts of the instructor, the educational value of the course materials and the excellent course content and information flow.

The report states that Contractors cited poor training in REMIS. Out of the 1,600 plus students who have attended REMIS courses (EIMSURS, PPS, or GCSAS) only 6 have been Contractors. These six have rated all areas on the student critiques with 5 or 6 ratings (see Attachment 6 for a sample of course critique).

Again, Attachment 6 is a copy of the critique form each student must complete upon graduation. If the students rated an area below 4 (3.5 is average), it is included in the category "other". Again, you will find that 95% of the students consistently rated all areas at a 4 or above.

PAGE V-39

The report states that, "Contractors have the following

opinions: They prefer working with raw tapes of Product Performance Data."

During the time frame of October 1992 through April 1993, more than a dozen Contractors who currently receive D056 data on tape were contacted. Each was offered the choice of continuing to receive tapes of Product Performance Data or log-on to REMIS to view their data or have the data sent across DDN to their computers.

None of the Contractors contacted elected to continue receiving data on tapes.

PAGE V-45 PARA D

The report states that, "Discussions with MAJCOM personnel, Weapon System SPO's and contractor personnel all favored TICARRS".

This statement makes it seem it was all MAJCOM, all SPO's, and all Contractors, while in fact, it was 1 MAJCOM (ACC), 1 or 2 SPO's (F-15 and F-16), and a handful of contractors. This group has been using TICARRS for over 10 years and are very familiar with it. Since REMIS is new, resistance should be expected.

PAGE V-46, PARA D.1

The report contends that data accuracy is an intrinsic problem with CAMS/REMIS due to the system architecture. The reader is lead to believe that fleet-wide edit and validations cannot occur in real-time mode. Currently, CAMS/REMIS has software in testing that enables a CAMS user to query the REMIS data base in on-line real time mode. This is the first step in providing CAMS base level users with fleet-wide data validation at the time the data is initially entered into CAMS. This capability is not addressed in Paragraph VII but should be. It is a viable alternative to a single centralized system architecture and represents a much smaller investment to the Air Force then does the expansion of TICARRS.

PAGE V-47 PARA 2

The difference in rounding flying hours has been corrected in EIMSURS. REMIS and CAMS round flying hours the same way.

PAGE V-52

It becomes clear when it is recognized that the same

maintainers who entered data directly into TICARRS entered data directly into CAMS. The difference is the Contractor Representatives for TICARRS doing the maintainer's job for them.

PAGE V-52 2ND SUBPARA AND FIGURE V-8

The last sentence states, "It is not clear from existing data whether the trend is showing a decline or remaining stable within the 20 to 40% range." A look at Figure V-8 clearly shows a steady decrease in errors from the PPS IOC through April 1993.

PAGE V-54, PARA D.3

If there are no problems with TICARRS security procedures as stated in this paragraph, why would "appropriate security procedures have to be developed"?

The report states that REMIS has a data security problem in that users are able to update configuration information on other than the weapon system the user is responsible for. The REMIS GCSAS software was modified in January 1993 to provide user access restriction by Equipment Designator (KC135 vs C141) for all approved configuration data. This modification is scheduled to be fielded prior to the first weapon system being implemented within GCSAS.

PAGE V-64, PARA E.2

Both CAMS and TICARRS utilize a network data base. The CAMS discussion describes a network data base as, "...very difficult to manage and control at the CSDB level". The TICARRS discussion describes a network data base as, "...suited to handling many data base activities rapidly". Does the report conclude that data bases are an asset or a handicap?

PAGE VII-3 First Paragraph

This paragraph implies that the CAMS portion of the SBLC is unknown. The IDA study team determined to use 50% "...as the factor to apportion SBLC and RPC variable costs to CAMS." Interestingly, the IDA study team had previously published in Table V-4, Page V-25, that the: "Percent of SBLC use due to CAMS" was specifically 43%. Why was the percentage raised for projecting future costs?

This same paragraph estimates that the fixed SBLC and RPC costs are 20% and the variable costs are 80%. No basis of estimate is provided to justify this estimate. It appears to be based on the convenience of the "80/20 rule" instead of

being based on factual data.

PAGE VII-4 TABLE VII-1

Justification for 2.5.1 Adjustment to Software Maintenance Costs

As described on page VII-7 and VII-8, the software applications maintenance is computed as 45 people per year at $43,099 per person. This equals $1.94M per year or $19.39M total for the ten-year period. The last sentence in the first paragraph on Page VII-8 should be deleted, since the computer support and system integration costs are listed separately as Line Items 2.5.4 and 2.5.5 respectively.

PAGE VII-4 AND VII-32

Comparison of Table VII-I and Table VII-10 shows some disparities in the costs for ALT 2.

1.1.1 - Given this is mid-July, will all RPC H/W costs be saved?

1.2.1 - It would be impossible to stop modifications to CAMS for three years even if it were phased out. Statutory and mission changes, new weapon systems/equipment and user pressure will force continued modifications.

2.3.2 - Cost for Base Representatives of $5.31M/yr for CAMS (Table VII-1) and "0" in ALT 2 doesn't pass logic test. If these people are not on-board now, then $5.31M worth won't be in place on 1 October 1993. Similarly, if they are already in place (i.e. maybe this refers to CAMS data base managers) then they will not all be gone on 1 October 1993, and there should be a cost to ALT 2.

PAGE VII-4 and VII-6, System Integration Test

Costs are included for CAMS independent system integration test but are not included for TICARRS (see Page VII-17).

PAGE VII-5, Approved Functional Modifications

The cost to provide additional functional modifications (CSRDs) to CAMS was included in the CAMS cost estimate. These new capabilities were not evaluated to determine if TICARRS required similar enhancements and the costs of these are not included in the TICARRS cost estimates.

PAGE VII-6

Cost are placed against CAMS for new weapon system support for the F-22, IMIS, etc. However, similar costs are not placed on TICARRS for the F-22 (see Table VII-6, Page VII-24).

PAGE VII-6 (CAMS Extensions and New Weapon Support)

There is no corresponding discussion for TICARRS, and new weapon systems (i.e., F-22) are not included in the data base initialization costs (Table VII-6).

PAGE VII-7 PARA 2E

Included in the Application Maintenance Costs for CAMS were the following: hardware maintenance, computer operations, and supplies in addition to "software maintenance" costs. These were not included in the TICARRS software maintenance cost estimate. (see Page VII-30, Para 2e).

PAGE VII-10 TABLE VII-2 1.2 AND VII-11 PARA 4.b

Improving Performance: The report estimate that 15 staff years for three years will be required. LCS estimates that no more than 10 staff years for three years would be considered for performance improvement as a non-recurring cost. These would consist of application analysts, system analysts, and programmers. Costs would be 10 people times $115,200 per staff year which equals $1.15M per year, or $3.46M for three years.

Improving REMISTALK: The report estimates 10 people for three years to expand and improve REMISTALK. LCS plans to use one person over the ten-year period to perform all REMISTALK related maintenance and enhancements. This will cost $115,200 per year, or $1.15M for the ten-year period. It may be more appropriate to consider this a recurring cost.

Initializing Data Base: With each REMIS subsystem placed in production, the data loaded into that subsystem's respective data base tables has been checked by existing staff. This task for GCSAS will be handled as part of normal operations by staff already accounted for under recurring costs. This task is much smaller than the report assumes and will be handled by existing staff during pre and post implementation of GCSAS as part of the recurring operations for REMIS. No additional non-recurring expense is required.

PAGE VII-13 PARA B AND C

LCS is projecting 21 personnel to operate the Network Control Center in FY94.

The ALCs require no manning. These sites are operated from the NCC in a "lights out" mode. No manning is projected for the ALCs. User support and operation of the computer systems are co-functions of the Network Control Center and are part of the 21 personnel projected above for FY94. Although LCS manpower projections might have to be increased with a large hardware upgrade, in no way do we see requirements for the 47 people as projected by IDA.

PAGE VII-16

The assumptions presented are unreasonable. If it is the government's intent to compare information systems which meet all of the users' requirements, no favoritism should be shown to either system. Since CAMS/REMIS must go through a MAISRC review, TICARRS should also. Since OT&E for CAMS/REMIS tests functionality and scope required for all weapons systems, OT&E for TICARRS should test the same functionality and scope requirements specified for the Air Force standard system they wish to replace. Preferential treatment should not be granted to either system.

The implication that TICARRS can be enhanced in six months to provide all of the CAMS/REMIS functionality is unrealistic. Omitted, and therefore assumed to be provided, is the requirement to also provide all of the scope of the CAMS/REMIS in TICARRS during the six-month enhancement. Without the scope enhancement, any comparison is an "apples to oranges" comparison.

PAGE VII-17 TABLE VII-4

Justification for VII-17 1.1.1 Recommended Adjustment to TICARRS Non-recurring H/W Costs

Page VII-5 references "additional funding in the out years to provide for hardware replacement and incidental hardware purchases". Table VII-1 estimates this additional funding for CAMS at $2M. This is approximately 7.2% of CAMS share of the RPC replacement costs for each of six years (FY1995-2000) and 5.3% for an additional two years (FY2002-2003). The percentages were determined as follows:

$2M / $27.90 x 100 = 7.2%
$1M / $18.75 x 100 = 5.3%

Similar "incidental hardware purchases" should be applied to TICARRS costs in Table VII-4.

The adjustment to VII-17 1.1.1 follows:

Sum the hardware purchases for 1994 and 1995. Calculating the "additional funding", we determine that $4.03M ($56M x 7.2% = $4.03M) is needed in years 1996 through 1999. Using the IDA team's assumption (see page VII-5, second paragraph under 1.a Hardware) that mainframe computer equipment will require replacement after seven years and that a 20% compound annual cost reduction will continue, we determine that the current TICARRS computer, which was purchased in 1990 for $3M will be replaced in 1996 for $0.8M. Likewise, the equipment purchased in 1994 and 1995 will be replaced in years 2000 and 2001. The "additional funding" for years 2002 and 2003 are calculated at 5.3% times the sum of the equipment purchased in the years 2000 and 2001 ($14.68M x 5.3% = $0.78M).

Justification for page VII-17 1.4.3 Training.

Page VII-27 specifies that each unit will require three weeks of training as part of the unit activation. Costs associated with student labor hours should be included and are estimated based upon the following:

Page V-25 states that average daily log-on for an average base is 196. The report specifies 107 bases. Thus:

107 locations x 196 log-ons	=	20,972 users
20,972 users @ 3 weeks ea (120 hrs)	=	2,516,640 hours
$43,099 salary ($43,099/1920)	=	$22.45 per hour
2,516,640 hours x $22.45 per hour	=	$56,498,568

This $56.5M in trainee costs will be allocated to FY1995 and FY1996 at $28.25M per year.

This training represents the costs associated with the transition of CAMS-trained users to the TICARRS system. NOTE: Training costs associated with personnel turnovers are considered to be substantially the same regardless of the system.

Justification for VII-17 2.2.1 Adjustment to Hardware and Software Maintenance Costs

On page VII-28 Paragraph b the report states that the "...cost for hardware maintenance is estimated to be 8% of the cost of the system hardware." "The cost of software license is increased to account for the additional number of processors in the configuration."

Table VII-4 identifies the FY1994 and 1995 mainframe costs to be $13.2M and Line Item 2.2.1 H/W, S/W, Utilities costs to be $1.89M. Calculating the hardware portion, we get $13.2M x 8% = $1.06M. To calculate the software costs included in Line Item 2.2.1, we subtract the hardware costs from the total costs ($1.89M - $1.06M = $.83M). These costs are based on supporting the 4.4 additional TICARRS computers estimated by IDA to support CAMS/REMIS users.

To determine the software license costs for each computer, we divide the software costs by the number of computers ($.83M/4.4 = $.19M).

Adjusting the software cost for the corrected number of computers, we multiply the software cost per computer ($.19M) by the corrected number of computers (18.66) to obtain the software cost of $3.5M per year.

Adjusting the hardware cost for the corrected number of computers, we multiply the hardware cost of $56M (18.66 x $3M) by the annual hardware cost factor (8%) to obtain the hardware cost of $4.48M per year.

We assume that the H/W, S/W, Utilities Line Item will remain static throughout the ten-year period as was assumed in costing the CAMS/REMIS estimates.

Adding the hardware and software costs together, we obtain an annual cost of $7.98M ($3.5M + $4.48M = $7.98M). This yields a ten-year cost of $79.8M.

Justification for VII-17 2.2.2 Civilian and Military Personnel

Page VII-15 states that TICARRS will utilize DPCs, terminals, and printers currently at various base locations, including the staffing to support equipment as outlined in the RPC plan.

Page VII-4 Table VII-1 2.2.3 states this cost is $11.38M per year. Page VII-17 Table VII-4 1.4 shows that unit activation costs will be distributed equally across FY95 and FY96. Page VII-26 Paragraph f states that unit (site), "activation will be carried out over a two-year period, beginning in FY1994".

Based on the specified unit activation schedule, the last unit will be implemented during FY1996; therefore, FY1996 Base Comm Operations should be estimated at the full rate of $11.38M. The 30% allocation of the $11.38M (3.83) should begin in FY1994 to support the aforementioned site activation schedule and the 67% (7.65) should be allocated to FY1995.

PAGE VII-18 AND VII-19

Mainframe sizing for TICARRS.

During the assessment period, an average of 44,018 daily TICARRS transactions were entered for one base, Seymour Johnson AFB. This number was derived from averaging the average transactions per day from weeks two through six of the assessment period (see page V-21, Table V-2). Week one was excluded due to abnormally low transaction rates resulting from users gaining experience with TICARRS, from an overloaded Data Communication Processor (DPC) and from an imbalanced central computer (see page V-21, second paragraph).

The daily transactions from all CAMS bases averaged 12,188 transactions per day per base (see page V-25, Table V-4 and page V-26, Figure V-4). As stated in the IDA report, some data collected during the TICARRS Operational Assessment had to be directly entered into CAMS, since TICARRS did not include all required functionality, such as engine end item data required for CEMS (see page V-11, paragraph i). If we assume that no more than an additional ten percent of the TICARRS' 44,018 daily transactions had to be entered into CAMS, then the TICARRS assessment personnel entered about 48,420 transactions per day. It is interesting to note that the average CAMS base can perform more functionality with a broader scope than TICARRS while at the same time entering only one-fourth the number of transactions.

Based upon the transaction rates, it is apparent that four TICARRS transactions must be entered for each equivalent CAMS transaction. Therefore, the equivalent number of daily first shift TICARRS transactions will be 1.2M CAMS transactions times 4 TICARRS transactions per CAMS transaction which equals 4.8M TICARRS transactions per day during the first shift.

Following the calculation methodology describe on page VII-19:

4.8M CAMS equivalent transactions divided by 20,000 average peak TICARRS transactions equals 240, the transaction processing multiplier.

240 x 4.6% = 1104% of current TICARRS power.
CAMS support requires 1104% of power used to support 20,000 TICARRS transactions during a peak 8-hour shift.

Current REMIS processing uses the following resources:

\HQ1,	12 VLX processors	@ 57%	= 6.84	VLX processors
\HQ2,	8 VLX processors	@ 15%	= 1.2	VLX processors
5 ALCs,	10 VLX processors	@ 15%	= 1.2	VLX processors
	Total		9.54	VLX processors

Each VLX processor is rated at 3.3 MIPS. Therefore, 9.54 processors times 3.3 MIPS per processor equals 31.5 MIPS at 100% utilization consumed for REMIS without the GCSAS subsystem being fully operational. Adding 25% to the current REMIS processor utilization for GCSAS yields 39.4 MIPS required to operate the FOC REMIS.

Since TICARRS central computer is rated as a 36 MIPS machine, 109% of a TICARRS computer is required to support REMIS users (39.4 MIPS / 36 MIPS = 109%).

The TICARRS power needed to support the CAMS/REMIS system is 1213% (1104% for CAMS plus 109% for REMIS).

TICARRS proposes to operate its computer at an average utilization of 65% during peak hours. Therefore, the increased size of the TICARRS computer will be 1213% / 65% or 18.66 times the current TICARRS computer resources.

Cost of the current TICARRS computer is $3M. The cost of the new central computer is $3M times 18.66 which equals $56M.

PAGE VII-21

CAMS also has interfaces with numerous systems. For example, INFOCEN for PQDR data. The CAMS SSO should be identified and the costs included in the cost of the TICARRS solution.

PAGE VII-21 TABLE VII-5

Some significant cost factors appear to have been overlooked in the TICARRS costing data:

- Enhancements. The analysis did not include C-E; this is a major enhancement. If the author feels it will take 1.3 staff years to include AGE, it will take 13 staff years to include C-E, since C-E requirements are at least 10 times the requirements of AGE.

- The analysis did not take into account how a central data system must be modified to interface with over 109 separate supply systems.

- No cost has been projected for FY94 for the correction of the over 400 Functional Disconnect Work-Around Write-Ups (FDWWS) nor for Difficulty Reports (DIREPS) discovered during the SJ Operational Assessment described on Page IV-9.

- No cost has been projected for loading REMIS data into TICARRS.

- The mainframe cost of two expenditures of $6.6 million each is based on a projected capacity of 4.4 times the current level. The 4.4 times estimate is believed to be severely understated. Please reference comments addressing Page V-36, Paragraph C.1.f. Costs associated with additional hardware above the 4.4 times should be reflected.

- Initialization costs for trainers and ATE equipment not currently supported by TICARRS are not included.

- The report assumes that all missing TICARRS functions can be provided with 30,000 additional lines of code (Page VII-30, Paragraph C.3.e(1). Based upon current CAMS/REMIS system sizing, LCS believes the SLOC estimate is understated by more than an Order of Magnitude (see Attachment 9). The cost associated with a more accurate estimate (from a source other than DRC) should be reflected in both the non-recurring and recurring areas.

System Software Interfaces.

REMIS does not send data to all the systems listed. It receives data from 4 of the 13 listed. It is easier to develop an SSO than an SSI interface. The report indicates that TICARRS can develop all 4 SSI's and 9 SSO's in 1.5 staff years. It took .5 staff years to develop the K002 interface and that is an SSO. Based on CAMS/REMIS experience, it would take 7.3 staff years to develop these interfaces.

PAGE V11-23 PARA D

None of the TICARRS documentation was developed IAW AFR 700 Series Regulations or DOD-I-7932. The cost to bring existing documentation up to standards and create future documentation IAW standards is too low at 10% of application software investment. This figure would more likely exceed 20-25% of application software investment.

PAGE VII-24

The cost for many weapon systems are not included. For example, the B-2, C-141, E-4, VC-137, C-22, C-140, and AGE equipment.

PAGE VII-24, TABLE VII-6

There are hundreds of different aircraft configurations; most are not addressed here. Some of the obvious omissions include B2, C-141 owned/operated by AFMC (many different series), E-4, Special Air Mission Aircraft (VC-137, C-22, C-140, etc.), and many -135 and -130 mission/series designators.

Same comments can be made about missiles and AGE equipment.

PAGE VII-27, PARA 3

User training only accounts for instructor time. There will be thousands of people (trainees) taken off their job for TICARRS training. Costs should be added.

The basis for the above-mentioned cost analysis and its conclusions appear to be seriously flawed.

Also, while the IDA team considered only two alternatives, several others are possible and may have considerably more merit. We have included two additional Alternatives (labeled Alternative 3 and Alternative 4) as Attachments 7 and 8 to these comments.

The IDA report analysis concludes that there is a cost differential of $106M favorable to TICARRS.

Alternative 3 presented herein as Attachment 7, concludes that there would be cost differential of $147M favorable to CAMS/REMIS.

Alternative 4 presented herein as Attachment 8, concludes that there would be a cost differential of $206M favorable to CAMS/REMIS.

It seems that more work on the cost estimates is warranted.

Litton
Computer Services

4020 Executive Drive
Dayton Ohio
45430
(513) 429-6450

February 3, 1993

Mr. Dave Roberts
H144 U.S. Capitol Building
Washington, D.C. 20515-6018

Dear Dave,

It was a pleasure seeing you at the American Logistics Infrastructure Improvement Consortium luncheon last Monday.

After lunch when we discussed your comment regarding the CAMS/REMIS Program "dropping data," you afforded me the opportunity to respond to that criticism.

Both CAMS/REMIS and TICARRS are chartered to provide accurate, timely operational, supply and maintenance data regarding the status of individual end items e.g. airplanes, missiles, automated test equipment, etc., and this data, translated into meaningful information, plays an important role for the near-term deployed systems and the mid-term soon-to-be deployed systems. In order to fairly compare the "dropping of data," or error rates, a number of factors must be considered. For example, CAMS/REMIS performs this function for significantly more end items than TICARRS:

ITEM	CAMS/REMIS	TICARRS
• Aircraft	10,555	2800
• Missiles	4,395	None
• Communications Electronics	1,054,000	None
• Aerospace Ground Equipment (including Automated Test Equipment)	60,000	500
• Simulators and Trainers	1,801	None

ATTACHMENT 1

Because TICARRs concerns itself almost exclusively with aircraft, and because the Air Force personnel responsible for inputting data into CAMS for aircraft are much more rigorous than those responsible for less mission-critical or life-threatening items such as test equipment, trainers, etc., a fair comparison should restrict itself to aircraft. The Air Force/Litton CAMS/REMIS team did a study in January, 1993 to determine the error rate for CAMS/REMIS aircraft only. Our analysis of 1,191,903 transactions showed 64,083 rejects for an error rate of only 5.38%, giving CAMS/REMIS an accuracy rate of 94.62%.

Since REMIS and TICARRS both receive their data from the same source, CAMS, any difference in accuracy rates would, almost certainly, result from differences in editing of the data by REMIS and TICARRS that is received from CAMS, e.g. if an Equipment Designator (ED) such as F016F is received by TICARRS it will be accepted as valid even though there is no F016F, and that's okay since TICARRS tracks by Block Number and not Equipment Designator. REMIS, on the other hand, tracks by both Equipment Designators and Block Numbers and rejects data that is not reconcilable from one to the other. This is not intended as criticism of the TICARRS, but is only offered by way of explanation as to why the CAMS/REMIS accuracy rate might be slightly different from TICARRS.

Also, for all of the problems identified in the inputting of data to CAMS by the functional users (in particular that data associated with items other than aircraft) corrective action has already been taken, or is underway.

Thank you for this opportunity to provide you with this information.

Sincerely,

Thomas F. King
REMIS Program Director

:b

COMPARISON OF CAMS/REMIS TO TICARRS 87 AND TICARRS 92

ATTACHMENT 2

CAMS/REMIS

SYSTEM REQUIREMENT	DOES CAMS/REMIS PROVIDE THIS CAPABILITY	DOES TICARRS PROVIDE THIS CAPABILITY	WHAT IS THE IMPACT
Provide to the user the Capability to:			
Load C-E Equipment - Establish Equipment Designator - Establish Mission Designator - Establish Organization - Establish Inventory - Establish Major Command - Establish Detachment Number	YES	NO: Reference TICARRS Demonstration Gunter AFB, 17 Dec 1992.	Baselevel user would not have the capability to maintain inventory or status on C-E Equipment. This impacts the ongoing ability to display assets to support a Units Mission.
Change C-E Equipment - Organization - Detachment - Major Command - Mission Designator	YES	NO: Reference TICARRS Demonstration Gunter AFB, 17 Dec 1992.	
Delete C-E Equipment - From Inventory (Major Command only)	YES	NO: Reference TICARRS Demonstration Gunter AFB, 17 Dec 1992.	
Inquire C-E Equipment - By Equipment Designator - By Major Command - By Type Equipment - By Equipment ID Number	YES	NO: Reference TICARRS Demonstration Gunter AFB, 17 Dec 1992.	

CAMS/REMIS

SYSTEM REQUIREMENT	DOES CAMS/REMIS PROVIDE THIS CAPABILITY	DOES TICARRS PROVIDE THIS CAPABILITY	WHAT IS THE IMPACT
Provide to the user the Capability to:			
Load Training Data - Name - Rank - AFSC - Workcenter Assignment - Training Requirement - Training Qualification /Certification - Schedule Training - Automate AF 623 (OJT Records)	YES	NO: Reference TICARRS Demonstration Gunter AFB, 17 Dec 1992.	Inability for an organization to control training and monitor training certification and qualification. Would not provide the ability to monitor the OJT program except by manual means. This also impacts the automated form entries and reduces the Units Mission Capability to determine maintenance qualification for "Red X" certification as well as various other maintenance requirement identification.
Change Training Data - Name - Rank - AFSC - Workcenter Assignment - Training Requirement - Qualification/ Certification - Class Schedules - Transfer Personnel Data Via Electronic Media	YES	NO: Reference TICARRS Demonstration Gunter AFB, 17 Dec 1992.	

CAMS/REMIS

SYSTEM REQUIREMENT	DOES CAMS/REMIS PROVIDE THIS CAPABILITY	DOES TICARRS PROVIDE THIS CAPABILITY	WHAT IS THE IMPACT
Delete Training Data - Qualifications/ Certifications - Class Schedules - Personnel - Workcenter Requirements	YES	NO: Reference TICARRS Demonstration Gunter AFB, 17 Dec 1992.	
Inquire Training Data By: - Name - Employee Number - AFSC - Class Schedule - Branch - Organization - Workcenter - Course Code - Future Training Requirements	YES	NO: Reference TICARRS Demonstration Gunter AFB, 17 Dec 1992.	

CAMS/REMIS

SYSTEM REQUIREMENT	DOES CAMS/REMIS PROVIDE THIS CAPABILITY	DOES TICARRS PROVIDE THIS CAPABILITY	WHAT IS THE IMPACT
Provide to the user the Capability to:			
Load Personnel Data - Personnel availability - Sick - TDY - Extra Duties - Duty Assignment - Workcenter - Branch - Organization - Identity Supervisor - Security Clearance - Shift/Crew - Air Reserve Technician and Air National Guard - Annual Evaluation Requirements	YES	NO: Reference TICARRS Demonstration Gunter AFB, 17 Dec 1992.	Denies the Deputy Commander for Maintenance the ability to effectively utilize resources. This directly impacts the Units Mission because of the inability to determine what resources are available for maintenance requirement or deployment.
Transfer Personnel Data Electronically	YES	NO: Reference TICARRS Demonstration Gunter AFB, 17 Dec 1992.	

CAMS/REMIS

SYSTEM REQUIREMENT	DOES CAMS/REMIS PROVIDE THIS CAPABILITY	DOES TICARRS PROVIDE THIS CAPABILITY	WHAT IS THE IMPACT
Change Personnel Data - Service Component - Grade - Duty Assignment - Supervisor - Security Clearance - Shift/Crew - Evaluation Dates	YES	NO: Reference TICARRS Demonstration Gunter AFB, 17 Dec 1992.	
Delete Personnel - From Organization	YES	NO: Reference TICARRS Demonstration Gunter AFB, 17 Dec 1992.	
Inquire By: - Employee Number - Workcenter - Organization - Branch - Unit	YES	NO: Reference TICARRS Demonstration Gunter AFB, 17 Dec 1992.	

CAMS/REMIS

SYSTEM REQUIREMENT	DOES CAMS/REMIS PROVIDE THIS CAPABILITY	DOES TICARRS PROVIDE THIS CAPABILITY	WHAT IS THE IMPACT
Provide to the user the Capability to:			
Maintenance and Supply Interface	YES	NO: Reference TICARRS Demonstration Gunter AFB, 17 Dec 1992. Parts ordered through supply terminal, then must manually load document number into TICARRS and subsequent update.	Baselevel user would be required to manually order parts from Base supply. Manually record document numbers, change status manually, show receipt of parts manually, manually search baselevel shops for tail number bins for assets, manually check arts in the inshop repair cycle. Loose overall ability to manage resources. Significantly reduce response time for generation of aircraft operation availability. Impacts an units capability to support deployable mission because of inability to secure assets and asset status in a timely fashion.
Format acceptable supply transaction - Generate Document Number - Update Supply with Document Number - Identify Asset Location on Base - Automatic Reorder Capability for Tail Number Bin Asset	YES	NO: Reference TICARRS Demonstration Gunter AFB, 17 Dec 1992.	

CAMS/REMIS

SYSTEM REQUIREMENT	DOES CAMS/REMS PROVIDE THIS CAPABILITY	DOES TICARRS PROVIDE THIS CAPABILITY	WHAT IS THE IMPACT
Provide to the user the Capability to:			
Supply Provides Status as occurs - Backorder Status - Issue Status - Maintenance Action to preclude MICAP condition - Maintenance Action to terminate MICAP condition - Maintenance Action To transfer MICAP condition	YES	NO: Reference TICARRS Demonstration Gunter AFB, 17 Dec 1992.	
Change Maintenance Supply Data: - Priority (Except MICAP) - Equipment ID - Urgency Justification Code - Job Control Number - Delivery Destination - Transfer Bit/Piece Data Between LRU's - DIFM Status	YES	NO: Reference TICARRS Demonstration Gunter AFB, 17 Dec 1992.	

CAMS/REMIS

SYSTEM REQUIREMENT	DOES CAMS/REMIS PROVIDE THIS CAPABILITY	DOES TICARRS PROVIDE THIS CAPABILITY	WHAT IS THE IMPACT
Provide to the user the Capability to:			
Inquire Maintenance Supply Data By: - Stock Number - Part Number - Material Acquisition Control Record - Interchangeable Substitution Group - Organization Cost Center Record - Project Fund Records - Equipment ID	YES	NO: Reference TICARRS Demonstration Gunter AFB, 17 Dec 1992.	
Engine Management and CEMS Interface	YES	NO: Reference TICARRS Demonstration Gunter AFB, 17 Dec 1992.	Baselevel user would have to attempt to revert back to a manual card method for tracking engine resources, configurations and status. User would loose visibility of asset conditions and availability which directly impacts mission capability.

CAMS/REMIS

SYSTEM REQUIREMENT	DOES CAMS/REMIS PROVIDE THIS CAPABILITY	DOES TICARRS PROVIDE THIS CAPABILITY	WHAT IS THE IMPACT
Provide to the user the Capability to:			
- Load Engine Actual Configuration - Load Previous Operating Line - Load part Serial Number Components - Work Unit Code - Date Installed - Multiple tracking capability	YES	NO: Reference TICARRS Demonstration Gunter AFB, 17 Dec 1992.	
Create Engine Status - Build-up - Spare - Installed - Removed - Shipped	YES	NO: Reference TICARRS Demonstration Gunter AFB, 17 Dec 1992.	
Change Actual configuration - Previous Operating Time - Work Unit Code - Part Serial Number - Tracking Method	YES	NO: Reference TICARRS Demonstration Gunter AFB, 17 Dec 1992.	

CAMS/REMIS

SYSTEM REQUIREMENT	DOES CAMS/REMIS PROVIDE THIS CAPABILITY	DOES TICARRS PROVIDE THIS CAPABILITY	WHAT IS THE IMPACT
Provide to the user the Capability to:			
CEMS Interface: - Create Remove/ Install actions - Show Utilization - Update Status - Receive Initialization Decks	YES	NO: Reference TICARRS Demonstration Gunter - AFB, 17 Dec 1992.	Air Force Would loose worldwide visibility of assets. Projection for spares acquisition, reliability and maintainability would be lost. Tracking of multiple methods manually would result in erroneous removes/ installs and parts/engines being removed prematurely or being overflown creating safety of flight situations. These missed capabilities directly affect mission performance and capability.
Inquire By: - Equipment ID - Equipment Designator - Organization	YES	NO: Reference TICARRS Demonstration Gunter AFB, 17 Dec 1992.	

CAMS/REMIS

SYSTEM REQUIREMENT	DOES CAMS/REMS PROVIDE THIS CAPABILITY	DOES TICARRS PROVIDE THIS CAPABILITY	WHAT IS THE IMPACT
Automated Maintenance Operation Control Center (AMOCC) Provide the user the capability to:			
Load Transient Aircraft - Equipment Designator - Serial Number - Major Command - Track/Report Status - Report MDC (PPS) - Track/Report Utilization - Inventory Possession (Gain/Losses)	YES	YES: Reference TICARRS Demonstration Gunter AFB, 17 Dec 1992. However TICARRS does not support C-E at all. Good graphic capability.	Baselevel user would be required to manually update grease boards to track C-E inventory possession (Gain/Losses) Status, Status Delay, Status comments. These actions would additional require message traffic from baselevel to higher Headquarters. These manual methods and human intervention would result in degradation of mission effectiveness.
Load C-E - Inventory Possession (Gains/Losses) - Status (Recision/ Start/Stop) - ETIC's - Status Delays - Status Comments - Active/Inactive Dates and times (Utilization)	YES	NO: Reference TICARRS Demonstration Gunter AFB, 17 Dec 1992.	

CAMS/REMIS

SYSTEM REQUIREMENT	DOES CAMS/REMIS PROVIDE THIS CAPABILITY	DOES TICARRS PROVIDE THIS CAPABILITY	WHAT IS THE IMPACT
Load Aircraft/Missiles/ Trainers/ATE - AFR 65-110 Inventory possession (Gains/ Losses/Termination) - AFR 65-110 Status (Reason/Start/Stop) - ETIC's - AFR 65-110 utilization (T.O./Landing Date/ Time Number Landing, Mission Code) - Report to MAJCOMS and USAF	YES	NO: Reference TICARRS Demonstration Gunter AFB, 17 Dec 1992.	
Load Transient Aircraft Data - Organization - Major Command - MDC - Utilization - Possession - ETIC's	YES	NO: Reference TICARRS Demonstration Gunter AFB, 17 Dec 1992.	

CAMS/REMIS

SYSTEM REQUIREMENT	DOES CAMS/REMIS PROVIDE THIS CAPABILITY	DOES TICARRS PROVIDE THIS CAPABILITY	WHAT IS THE IMPACT
Change C-E Data - Possession - Status - ETIC's - Status Delay - Status Comments	YES	NO: Reference TICARRS Demonstration Gunter AFB, 17 Dec 1992.	
Change Aircraft/Missiles/ Trainer/ATE - Possession - Status - Utilization - ETIC's	YES	YES: Reference TICARRS Demonstration Gunter AFB, 17 Dec 1992. However TICARRS can update status, utilization and ETIC's	
Inquire By: - Equipment ID - Equipment Designator - Type Equipment - Workcenter - Organization - Unit	YES	NO: Reference TICARRS Demonstration Gunter AFB, 17 Dec 1992.	

CAMS/REMIS

SYSTEM REQUIREMENT	DOES CAMS/REMIS PROVIDE THIS CAPABILITY	DOES TICARRS PROVIDE THIS CAPABILITY	WHAT IS THE IMPACT
Provide the user the capability to:			
Enter Personnel Availability - Determine qualified Dispatch Availability - Determine Qualified In-Shop Availability - Create preplan Maintenance Schedule.	YES	NO: Reference TICARRS Demonstration Gunter AFB, 17 Dec 1992.	Baselevel personnel would be required to submit numbers and skills of personnel available by shift through manual paperwork. The AMOCC would be required to manually maintain personnel available for dispatch on grease boards. Because of inaccuracy in manually maintaining personnel availability, mission capability is directly impacted due to human intervention when maintenance events are started/stopped.

CAMS/REMIS

SYSTEM REQUIREMENT	DOES CAMS/REMIS PROVIDE THIS CAPABILITY	DOES TICARRS PROVIDE THIS CAPABILITY	WHAT IS THE IMPACT
Provide to the user the Capability to:			
Maintain Next Scheduled Inspection - Phase - HSC - BPO - PE	YES	NO: Reference TICARRS Demonstration Gunter AFB, 17 Dec 1992.	The ability to meet operational commitments requires that inspections be accomplished when they are required, otherwise generation of aircraft to support missions is severely impacted.
Generate Daily/Weekly/ Monthly Maintenance/ Flying Schedule - Determine all Scheduled Maintenance Requirements - Date - Time - Duration	YES	NO: Reference TICARRS Demonstration Gunter AFB, 17 Dec 1992.	Baselevel users would be required to utilize grease boards to produce a daily, weekly, and monthly maintenance and Flying schedule to project the availability of aircraft and personnel resources required to support the ongoing and projected maintenance requirement in support of the units mission.
- Load All Operational Requirements	YES	NO: Reference TICARRS Demonstration Gunter AFB, 17 Dec 1992.	

CAMS/REMIS

SYSTEM REQUIREMENT	DOES CAMS/REMIS PROVIDE THIS CAPABILITY	DOES TICARRS PROVIDE THIS CAPABILITY	WHAT IS THE IMPACT
Provide to the user the Capability to:			
- Load Weapons Configuration Requirements - Tanks - Pylons - Racks	YES	NO: Reference TICARRS Demonstration Gunter AFB, 17 Dec 1992.	
- Generate Schedules	YES	NO: Reference TICARRS Demonstration Gunter AFB, 17 Dec 1992.	
Create Automated Aircraft Forms - Generate 781-A - Generate 781-J - Generate 781-K - Generate Maintenance Symbols Associated with Discrepancies - Identify Discovered By - Identify Corrected By - Identify Inspected By	YES	NO: Reference TICARRS Demonstration Gunter AFB, 17 Dec 1992.	Baselevel users would be required to revert back to manual methods of forms generation. This reversion could impact mission performance due to the system not automatically checking to see if the individual is allowed to clear "Red X" conditions or is certified for the specific work he is accomplishing.

CAMS/REMIS

SYSTEM REQUIREMENT	DOES CAMS/REMIS PROVIDE THIS CAPABILITY	DOES TICARRS PROVIDE THIS CAPABILITY	WHAT IS THE IMPACT
Provide to the user the Capability to:			
Generate PQDR - Create PQDR - Update PQDR - Create Suspense Records - Interface with INFOCEN	YES: However INFOCEN does not return data to CAMS/ REMIS electronically. Capability was planned for but CAMS/REMIS FRB deleted requirement.	YES: Reference TICARRS Demonstration Gunter AFB, 17 Dec 1992. However all processes must be through the TICARRS central Database and reformatted for INFOCEN. INFOCEN does provide TICARRS with updates.	

COST TO UPGRADE TICARRS

EXPANDED LINES OF CODE	
C-E	56,176
TRAINING	178,830
PERSONNEL	51,774
CEMS	282,066
AUTOMATED FORMS	28,169
SBSS	295,922
TOTAL LOC	892,937

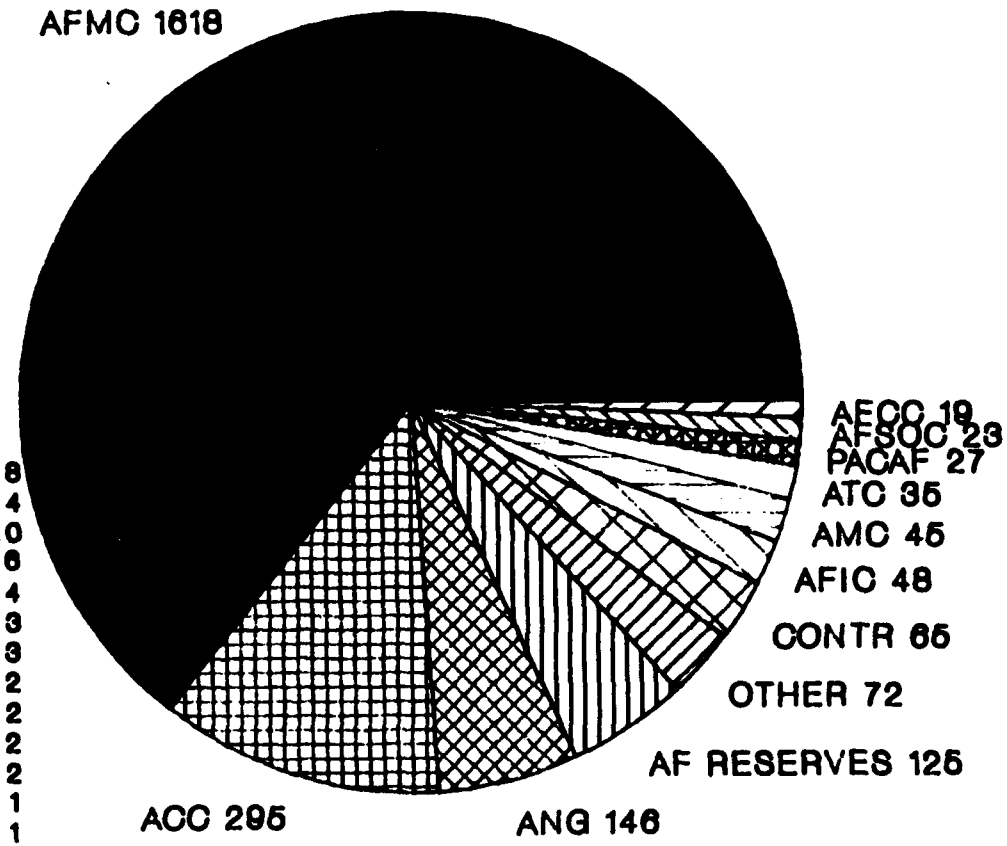
UNEXPANDED LINES OF CODE	
C-E	21,291
TRAINING	49,040
PERSONNEL	18,762
CEMS	124,749
AUTOMATED FORMS	10,321
SBSS	126,200
TOTAL LOC	350,363

- CONTRACTOR COST:
  350,363 LINES OF CODE AT 1HR/LINE = 350,363 HOURS
  350,363 @ $50.00 / HR = $17,518,150
- TOTAL COST TO AIR FORCE:
  CONTRACTOR COST + AIR FORCE COSTS = TOTAL COST TO AIR FORCE
  $17.5M + .5 (17.5)M = $26,250,000

REMIS USERS

(INDIVIDUALS AUTHORIZED ACCESS)

AS OF 1-JUL-93



OTHER

USAF	18
SPACECOM	14
USAFE	10
AF ACADEMY	6
AF SAFETY AGENCY	4
AFIT	3
CENTRAL COMMAND	3
AF COST ANAL AGENCY	2
AFOTEC	2
NAT WEATHER SERVICE	2
AUDIT AGENCY	2
ACCOUNTING & FINANCE	1
AF HISTORICAL RES CTR	1
NAVY	1
OSD	1
DLA	1
SAF	1

TOTAL 2618

HQS:JULUSERS

ATTACHMENT 3

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS UNITED STATES AIR FORCE

HQ USAF/LG
1030 Air Force Pentagon
Washington, DC 20330-1030

24 MAY 1993

Honorable Daniel K. Inouye
Chairman, Subcommittee on Defense
Committee on Appropriations
United States Senate
Washington, D.C. 20510-6025

Dear Mr. Chairman

As I indicated to you in my 17 Feb 93 letter, we were preparing to conduct an operational assessment of TICARRS 92, developed by the Dynamics Research Corporation (DRC), at Seymour Johnson AFB, NC. We have completed the assessment and I wish to take this opportunity to forward a copy of the Assessment Team's report. I believe that the assessment detailed in this report was both thorough and balanced. In addition to the Wing maintenance personnel, we had 127 Air Force personnel temporarily assigned to Seymour Johnson AFB for 11 weeks to ensure we evaluated TICARRS 92 in a realistic scenario. We spent an estimated $1.3 million on this effort.

Let me review the rules of engagement employed during the assessment:

- TICARRS 92 functionality was assessed on its ability, as portrayed to the Air Force by DRC, to support wing operations using CAMS/REMIS functions as a baseline.

- TICARRS 92 functional capabilities were baselined as of 11 Feb 93.

- CAMS/REMIS was kept current using dual reporting procedures to maintain data base integrity.

- Any procedures or workarounds identified to those systems where TICARRS 92 was non-functional were documented, made part of the test plan, and included in the report.

- Software would be baselined and frozen prior to the assessment.

The report details that TICARRS 92 has positive features. However, it lacked functionality in 6 of the 22 CAMS major subsystems: the standard base supply system, comprehensive engine management system, personnel/training, automated forms, aerospace ground equipment management and communications-electronics. In

addition, three other CAMS subsystems, which the contractor had stated were available in TICARRS 92: product quality deficiency reporting, query, and cannibalizations did not function. This lack of functionality in a total of 9 out of 22 subsystems, coupled with numerous other problems identified during the assessment, indicates that TICARRS 92 was clearly not ready to operate as advertised, and in its tested configuration did not provide a significant improvement over CAMS/REMIS. Reflecting the above shortfalls, in the assessed ability to help perform duties, training and overall satisfaction with the two systems, the users preferred CAMS/REMIS.

Based on this report, we believe the Government would incur significant costs to fully replicate the functionality currently resident in CAMS/REMIS and to correct the TICARRS 92 functional disconnects identified by the team. The exact cost to develop these features will be provided by the Institute for Defense Analysis (IDA) in their Congressionally directed independent cost analysis of the two systems due to be completed in September 93.

Appendix O of this report contains Assessment Team comments in response to questions from the Air Force Program Executive Officer for Information Systems. Comments provided to the Air Force in a recent DRC document presented quotes from these responses; those quotes are included in their full context in the report. I think you will find the complete quotes of more value in assessing TICARRS 92.

The next step is the completion of the IDA study. We look forward to receiving that report and working with you on final resolution of this issue. We plan to make no judgements relative to the future of TICARRS 92-CAMS/REMIS until we have thoroughly reviewed the IDA study. We will then provide you final recommendations on this issue. In the meantime, TICARRS will continue to operate as before at those units it currently supports. Additionally, in the interest of maintaining the most combat ready force possible, I intend to continue with the planned CAMS/REMIS enhancements to better serve our users, and provide the best possible maintenance management information system.

I appreciate your continued interest and support of this effort, and I will keep you advised of any future developments.

Sincerely,

Trevor A. Hammond

Trevor A. Hammond, Lt Gen, USAF
DCS/Logistics

1 Atch:
TICARRS 92
Assessment Report

COURSE NO: EIOSH4925-011	COURSE NAME: REMISTALK USERS COURSE
YOUR NAME:	DATE:
JOB TITLE:	PHONE:
DEPARTMENT:	BASE:

Please circle the response that most closely reflects your impression of this training, instructor, the materials, and the content that was presented. Your feedback helps improve the quality of the training that is offered.

I. INSTRUCTOR	EXCELLENT					UNACCEPTABLE
a) overall effectiveness	6	5	4	3	2	1
b) knowledge of subject matter	6	5	4	3	2	1
c) held your interest	6	5	4	3	2	1
d) amount of interaction/questions	6	5	4	3	2	1
e) organization	6	5	4	3	2	1
f) met the course objectives	6	5	4	3	2	1

Quality of Instruction Comments: _____

II. WRITTEN MATERIALS (EXCEPT CAI)	EXCELLENT					UNACCEPTABLE
a) organization of materials	6	5	4	3	2	1
b) ease of understanding the materials	6	5	4	3	2	1
c) quality of printed materials	6	5	4	3	2	1
d) quality of view graphs/visual aids	6	5	4	3	2	1
e) appropriateness of examples	6	5	4	3	2	1
f) educational value of the exercises	6	5	4	3	2	1

Quality of Written Material Comments: _____

17377

COURSE NO: E1OSH4925-009	COURSE NAME: REMIS GCSAS USERS COURSE
YOUR NAME:	DATE:
JOB TITLE:	PHONE:
DEPARTMENT:	BASE:

Please circle the response that most closely reflects your impression of this course, instructor, the material, and the content that was presented. The CAI is rated on pages 3 thru 6. Your feedback will help improve the quality of the training that is offered.

I. INSTRUCTOR	EXCELLENT					UNACCEPTABLE
a) overall effectiveness	6	5	4	3	2	1
b) knowledge of subject matter	6	5	4	3	2	1
c) held your interest	6	5	4	3	2	1
d) amount of interaction/questions	6	5	4	3	2	1
e) organization	6	5	4	3	2	1
f) met the course objectives	6	5	4	3	2	1

Quality of Instruction Comments: _____

II. WRITTEN MATERIALS (EXCEPT CAI)	EXCELLENT					UNACCEPTABLE
a) organization of materials	6	5	4	3	2	1
b) ease of understanding the materials	6	5	4	3	2	1
c) quality of printed materials	6	5	4	3	2	1
d) quality of view graphs/visual aids	6	5	4	3	2	1
e) appropriateness of examples	6	5	4	3	2	1
f) educational value of the exercises	6	5	4	3	2	1

Quality of Written Material Comments: _____

0652 H# 1.0 I

ALTERNATIVE 3

CONSOLIDATED CAMS/REMIS OPERATION

CAMS/REMIS is consolidated and modified and remains the Air Force standard system. TICARRS is retired.

This Alternative provides for data editing and control and other CAMS enhancements outlined in Alternative I. In addition, it would move the CAMS operation to the REMIS facility and provide for a computer to operate CAMS like TICARRS from a central location. User support would be provided as in REMIS.

As a result of a consolidated CAMS/REMIS operation, the cost of CAMS Data Base Managers ($54M) would be eliminated. The RPC costs of $186 million would be decreased to the cost of an additional computer from the CAMS portion of CAMS/REMIS.

With a co-located operation, the cost of the high-speed REMIS data links would be eliminated.

Chart I shows costs for a co-located CAMS/REMIS operation. Additional benefits by operating CAMS like REMIS would be the increased availability equal to REMIS and a system response time, amounting to under 3 seconds.

1. Non-Recurring Costs

a. Hardware

New hardware non-recurring costs are projected at $13M to provide a centralized CAMS operation. Some of this cost could be greatly reduced with the utilization of excess standard base level computers which are removed under DMR 924.

Year seven hardware replacement costs are determined by using IDA's 90% replacement figures for equipment replaced after seven years. Technology advances over the next seven years should allow for the purchase of the same performance at a cost of $3.4M (assuming the 20% compound annual cost reduction for mainframe computers equipment continues).

b. Software

This element of the cost estimate is concerned with the cost of further development of the CAMS application after 1993. The CAMS/REMIS PMO is not projecting any funds for this purpose past 1993, except those funds provided by organizations wishing to enhance CAMS to support a specific weapon system or activity.

Application Software

Approved functional modifications

CAMS has approved functional modifications (CSRDs) amounting to approximately 30 person-years of effort (CAMS estimate). This is projected to extend over a three year period or 10 person-years per year for three years.

Enhanced data editing and control

CAMS must be modified so that the data entry editing is not only less onerous, but fully edited, such that erroneous data is refused at the point of entry, and at the time of entry. This enhancement would totally replace the current process of REMIS responding to the individual bases with error messages an hour or two after the fact, with the expectation of error correction by the flight line personnel. The estimates for enhanced data editing and control would require about 15 person-years of development team effort per year for three years, including the ability to communicate immediately with REMIS for data verification on a fleet-wide basis as necessary.

CAMS Extensions and new weapon support

Funding is included to facilitate the addition of forthcoming requests for CAMS support for the F-22, IMIS, REMPOD, Job Cost Accounting, CEMS interface, deployable CAMS, and REMIS support. This funding is 10 person-years for three years.

All of the work includes documentation and is projected to be completed by contractor personnel at the rate of $60 per hour.

Enhanced Client/Server

Under this alternative, the centralized CAMS requires additional software to support directing data to the correct logical CAMS data base. This software is estimated at 22,300 SLOC.

Report page VII-30 specifies 30,000 SLOC as the size of the 8 functional enhancements.
Report page VII-1 specifies a staff year as equal to 1,920 hours.
Report page VII-2 specifies that software engineering labor is equal to $60/hour or $115,200/staff year.
Report page VII-21 specifies that the eight enhancements will require 14 staff years to develop.

Based upon these references, SLOC per staff hour was calculated as follows:

14 staff yrs x 1,920 hours per yr	=	26,880 staff hours
30,000 SLOC divided by 26,880 staff hrs	=	1.1160714 SLOC per staff hour
1.1160714 (prod rate) x 22,300 SLOC	=	24,888 development hours
$60/hr rate x 24,888 dev hours	=	$1,493,280

System Integration and Test

This function is currently performed by the SSC QT&E group at Gunter AFB. The costs projected for this item are a function of the application development effort. The study team estimated that 15 person-years per year for the first three years would cover the necessary effort. This not only includes integration of the CAMS application into the SBLC and RPC software, but also includes distribution to the various using organizations. This work is projected at an annual rate of $43,099 per staff year.

2. Recurring Costs

a. Government Program Management

This is the projected expense for program management of CAMS. This cost is estimated to be 10% of the staff supporting CAMS in development, maintenance, and bases representatives.

b. Computer operations and maintenance

Operation of a centralized operation would require twelve people in this category. The annual rate of $44,576 x 12 is what IDA has estimated for this area.

Hardware/software operation costs are based on a percentage of IDA's costs in the amount of $3.59M for five RPCs for CONUS operations. The cost of CAMS has been estimated by IDA to rise 40% per RPC, this percentage was used as the factor.

c. Base communication operations

This cost was devised for support of one E-7 @ 107 base for communication equipment maintenance and terminal support. The projected E-7 cost is $49,591 per year per representative, as per the IDA study.

Costs for hardware and software are based on Commercial off the shelf (COTS) client/server operation and equipment.

d. User Support

User support will be provided in the same manner as currently provided by REMIS. User support personnel costs are based on IDA $41,299 per person-year. Twelve personnel will provide user help at a consolidated function.

e. Software Maintenance

Application Maintenance. This cost element provides funds for the maintenance of CAMS software. Software maintenance includes correcting and testing software errors reported by users (Discrepancy Reports or DIREPs), making modifications to the CAMS data base to enhance performance, or add/correct data relationships. Recent CAMS history indicates that about 40% of the CAMS staff (45 staff members) are needed to address the current maintenance workload. The study team estimates that this level of effort will be required for the foreseeable future. Since CAMS consists of approximately 1.1 million lines of unique source code, this results in the maintenance of 24,961 unique lines of source code per staff year. This is in line with typical industry averages for data base applications which vary between 20,000 and 32,000 unique lines of source code per staff year [Boehm, p. 541]. This work will be performed by a mixture of military and civilian personnel at an average rate of $43,099 per year. This line item includes funds for computer support and system integration and release as follows:

Operations. This item projects the cost of providing the necessary computer support to the CAMS application maintenance personnel. The cost detail is described in Table A. The maintenance effort is projected to require two computer systems to perform its work.

Table A CAMS development operation support estimates

Hardware Maintenance	$ 71,000 per system per year
Software Maintenance	$ 20,000 per system per year
Computer operators (5)	$150,000 per system per year
Supplies, Misc.	$ 20,000 per system per year
Subtotal	$260,000 per system per year

System Integration and Test. This function is performed by the QT&E group at the Gunter AFB SSC. The cost projections are based on a prorated share of the current QT&E support (75 personnel). About half of the current personnel are allocated to CAMS. CAMS maintenance is expected to drop to about 40% of its current level. We estimated 40% of the 37 QT&E personnel to be required for maintenance support at a cost of $43,099 per person-year.

Data Base Management. This effort is staffed by the CAMS organization at the Gunter SSC and includes making modifications to the CAMS data base to enhance performance, or add/correct data relationships that are encountered by the users. The study team estimated this effort to require four experienced data base managers at an average rate of $43,099 per year. This function would move to the central CAMS/REMIS operation.

Documentation. These funds include resources to modify and update the software documentation in accordance with the changes due to the software and data base maintenance. This is estimated to require two staff years per year, which is 5% of the application software resources.

Training and Travel. Training costs of the CAMS users are carried by the individual bases and are expected to be substantially the same regardless of the specific weapons maintenance information system used. The CAMS base representatives will require training on a continuous basis as personnel are reassigned. The training and travel costs are estimated to be 2% of the CAMS controlled funds.

New Recurring Cost. Sprint communication lines as prepared for TICARRS would be used for CAMS. This would be 107 dedicated lines to a centralized CAMS operation. Costs are based on IDA costing for TICARRS.

Lines to RPC. This cost is based on the IDA cost per Table VII-4 2.4.2 for TICARRS RPC line costs.

Data Base System Manager. Data base management and functional support in a consolidated operation. A total of ten data base managers and five functional personnel will be required for this aspect of the operation.

Cost for the DBM are based on IDA DBM cost of $43,000. Function support are based on REMIS costs of $36,000 per person per year.

CHART I
ALTERNATIVE 3

PROJECTED MODIFIED CAMS COSTS FOR YEARS
1994 - 2003 (MILLIONS IN 1994 DOLLARS)

		1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	TOTAL
1.0	MONTHLY RECURRING											
1.1	HARDWARE	13.000							3.400			16.400
1.2	SOFTWARE											0.000
1.2.1	APPLICATION S/W											0.000
	APPROVED CRSD	1.150	1.150	1.150								3.450
	ENHANCED EDITING	1.730	1.730	1.730								5.190
	NEW WEAPONS/EQUIP	1.150	1.150	1.150								3.450
	ENHANCED CLIENT/SERVER	0.498	0.498	0.498								1.494
	SYSTEM INT & TEST	0.650	0.650	0.650								1.950
1.2.3	DOCUMENTATION	0.200	0.200	0.200								0.600
	NON-RECURRING SUBTOTAL	18.378	5.378	5.378	0.000	0.000	0.000	0.000	3.400	0.000	0.000	32.534
2.0	RECURRING COSTS											0.000
2.1.1	GOVERNMENT	1.450	1.400	1.400	0.900	0.900	0.900	0.900	0.900	0.900	0.900	10.550
2.2	COMPUTER OPERATIONS											0.000
	CIV & MIL PERSONNEL	0.530	0.530	0.530	0.530	0.530	0.530	0.530	0.530	0.530	0.530	5.300
	H/W, S/W, UTIL	0.120	0.120	0.120	0.120	0.120	0.120	0.120	0.120	0.120	0.120	1.200
2.2.3	BASE COMM OPERATIONS											0.000
	CIV AND MIL PERSONNEL	5.300	5.300	5.300	5.300	5.300	5.300	5.300	5.300	5.300	5.300	53.000
	H/W, S/W, UTIL	0.107	0.107	0.107	0.107	0.107	0.107	0.107	0.107	0.107	0.107	1.070
2.3	USER HELP											0.000
2.3.1	FIELD HELP GROUP	0.510	0.510	0.510	0.510	0.510	0.510	0.510	0.510	0.510	0.510	5.100
2.5	S/W MAINTENANCE											0.000
2.5.1	APPLICATIONS S/W	3.110	3.110	3.110	3.110	3.110	3.110	3.110	3.110	3.110	3.110	31.100
2.5.2	DATA BASE MANAGEMENT	0.170	0.170	0.170	0.170	0.170	0.170	0.170	0.170	0.170	0.170	1.700
2.5.3	DOCUMENTATION	0.090	0.090	0.090	0.090	0.090	0.090	0.090	0.090	0.090	0.090	0.900
2.5.4	S/W MAINT OPERATIONS	0.520	0.520	0.520	0.520	0.520	0.520	0.520	0.520	0.520	0.520	5.200
2.5.5	SYSTEM INT & TEST	0.650	0.650	0.650	0.650	0.650	0.650	0.650	0.650	0.650	0.650	6.500
2.6	TRAINING & TRAVEL	0.820	0.310	0.310	0.170	0.170	0.170	0.170	0.170	0.170	0.170	2.630
3.0	NEW RECURRING COSTS											0.000
3.0.1	SPRINT COMM LINES		1.670	1.670	1.670	1.670	1.670	1.670	1.670	1.670	1.670	15.030
3.0.2	LINES TO RPC		0.210	0.210	0.210	0.210	0.210	0.221	0.210	0.210	0.210	1.901
3.0.4	DATA BASE SYS MANAGERS		0.610	0.610	0.610	0.610	0.610	0.610	0.610	0.610	0.610	5.490
	RECURRING SUBTOTAL	13.377	15.307	15.307	14.667	14.667	14.667	14.678	14.667	14.667	14.667	146.671
	TOTAL COST	31.755	20.685	20.685	14.667	14.667	14.667	14.678	18.067	14.667	14.667	179.205

CHART 2
ALTERNATIVE 3

SUMMARY OF COMPARISON COSTS OF A CONSOLIDATED
CAMS/REMIS VERSUS TICARRS

TICARRS AND REMIS COSTS ARE DERIVED FROM THE IDA STUDY. CAMS COSTS ARE FOR A CONSOLIDATED CAMS OPERATION.

ENHANCED AND CONSOLIDATED CAMS/REMIS

	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	TOTAL
CAMS	31.740	20.670	20.670	14.800	14.800	14.800	14.800	18.200	14.800	14.800	180.080
REMIS	23.900	18.180	16.510	18.890	11.990	11.990	11.990	13.400	11.990	11.990	150.830
TOTAL COST	55.640	38.850	37.180	33.690	18.590	26.790	26.790	31.600	26.790	26.790	330.910

EXPANDED TICARRS

	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	TOTAL
TICARRS	29.510	51.400	52.540	48.730	48.730	48.730	49.850	49.590	47.840	47.840	474.760

COMPARISON OF ALTERNATIVES SHOWS THE CONSOLIDATED CAMS/REMIS IS ESTIMATED TO HAVE LOWER TEN-YEAR COSTS THAN THE ALTERNATIVE, BASED ON EXPANDED TICARRS. IN PRESENT VALUE TERMS, THIS ALTERNATIVE IS $144.1M CHEAPER, A SAVINGS OF 31%.

ALTERNATIVE 4

CONSOLIDATED CAMS/REMIS WITH REMIS HARDWARE UPGRADE

CAMS/REMIS is consolidated and modified, the REMIS hardware suite is upgraded, and CAMS/REMIS remains the Air Force standard system. TICARRS is retired.

This alternative approach builds on Alternative 3, by including all initiatives in Alternative 3 and adding a REMIS hardware upgrade of the current Tandem VLX suite to Tandem Cyclones. In addition, current tape back up and archiving would be replace with optical disk technology. Further current systems operating at the five AFMC ALCs would be migrated to Cyclone processors.

Costs associated with this alternative have been well documented in a Business Case developed by the REMIS PMO. An investment of approximately $19 M in replacement Tandem equipment will net a continuous savings in excess of $8 M per year, every year, for the life of AFMC Tandem operations. This equates to a pay back on investment of under three years. Chart 1 portrays these savings, and identifies a further gap in ten year cost projections between the CAMS/REMIS and TICARRS options.

1. Non-Recurring Costs

a. Hardware Purchase and Maintenance

Projected first year hardware upgrade costs are estimated to be $16.8 M. Included in these costs are the replacement of all REMIS Tandem VLX hardware with Tandem Cyclones. Cyclone-R equipment would be installed at the five ALCs, replacing all TXP, NSII, and VLX equipment currently in place. Current procedures for tape back up and archiving would be replace through use of newly installed optical disk storage devices at the five ALCs and at Headquarters AFMC. The current REMIS Network Control Center (NCC) would be upgraded to accommodate the increased requirements of operating additional ALC systems (Exchangeable Production System - EPS, Inventory Tracking System - ITS, and the Depot Time and Accounting System). In addition, costs have been included for an uninterrupted power source (UPS), to ensure continuous service even in power outage situations. Hardware installation is also included in this projection. First year maintenance is included in the purchase price of the upgrade. Thereafter, system maintenance is vastly reduced since a single configuration will be resident at the ALCs and the number of processors required to operate REMIS under Cyclone technology will be reduce.

b. Software

Included in the cost of hardware installation, is the

conversion of all current system software to the Tandem C-30 release. In addition, all software not now operating of Cobol 85 will be upgraded to that capability.

2. Recurring Costs

a. Personnel Costs

As a result of the hardware system upgrades, personnel operating costs are drastically reduced. Analysis shows there will be a net savings of 65 personnel equivalents based on this alternative. Total recurring personnel costs will be reduced from $7.8 M to $2.1 M per year. This is possible through use of lights out technology. Since all operations of ALC Tandem equipment will be controlled from the REMIS NCC, at Headquarters AFMC, no operations personnel are required at the ALCs. Personnel support required under the upgrade is limited to staff increases at Headquarters AFMC REMIS operations. This will accommodate an increase in customer support requirements from existing ALC systems and for existing system programmer support. In addition, costs have been included for a performance and capacity planning team. Experience has shown that as applications mature and change, there is a continuous need to review the methodology used in employing the use of Tandem technology. This constant review allows for the most efficient operations and lowest cost per processing second. With the requirement to support three additional systems, there will be a significant cost benefit to increase the current team to monitor these additional systems.

b. Facility Costs

Environmentally controlled space requirements are significantly reduced by implementing this alternative. Current system configurations require in excess of 4000 square feet of footprint. The proposed upgrade would reduce this requirement to just over 600 square feet. Thus, yearly heat, power, and footprint costs are reduced by $700 K per year.

3. Existing System Cost

a. Hardware Maintenance

Maintenance of all AFMC system is a significant yearly cost. Under current configurations, AFMC is incurring a yearly maintenance cost for Tandem equipment in excess of $1.5 M.

b. Personnel Costs

System support costs for ALC personnel are a major element of existing systems operating costs. Personnel support for EPS, ITS, and the Time and Accounting System, amount to over $7.8 M per year.

c. Facility Costs

Heat, power and footprint costs to operate current Tandem configurations at all locations are in excess of $800 K per year.

d. Existing System Cost Summary

Total system support costs for all AFMC Tandem equipment amount to nearly $10.5 M per year. The data portrayed in this section is fully substantiated in the MSC/SRB Business Case For The Consolidation and Upgrade of AFMC Tandem Computers, dated 22 June 1993.

4. Net Cost Summary

In order to implement this alternative there is an initial investment of approximately $19 M. This however, is offset by a continuous yearly savings in excess of $8 M. Thus after just over two years, there is a complete return on investment and a further continuous savings of $8 M per year. These statistics have been overlaid on the Alternative 3 Chart 1 and are shown on Chart 1 of this alternative.

CHART 1
ALTERNATIVE 4

SUMMARY OF COMPARISON COSTS OF A CONSOLIDATED
CAMS/REMIS WITH REMIS HARDWARE UPGRADE VERSUS TICARRS

TICARRS AND REMIS COSTS ARE DERIVED FROM THE IDA STUDY. CAMS COSTS ARE FOR A CONSOLIDATED CAMS OPERATION.

ENHANCED AND CONSOLIDATED CAMS/REMIS

	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	TOTAL
CAMS	31.740	20.670	20.670	14.800	14.800	14.800	14.800	18.200	14.800	14.800	180.080
REMIS	23.900	18.180	16.510	18.890	11.990	11.990	11.990	13.400	11.990	11.990	150.830
HOW INVEST	19.061										19.061
HOW SAVING	(8.2)	(8.2)	(8.2)	(8.2)	(8.2)	(8.2)	(8.2)	(8.2)	(8.2)	(8.2)	(82.000)
TOTAL COST	66.501	30.65	28.980	25.490	18.590	18.590	18.590	23.400	18.590	18.590	267.971

EXPANDED TICARRS

	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	TOTAL
TICARRS	29.510	51.400	52.540	48.730	48.730	48.730	49.850	49.590	47.840	47.840	474.760

COMPARISON OF ALTERNATIVES SHOWS THE CONSOLIDATED CAMS/REMIS IS ESTIMATED TO HAVE LOWER TEN-YEAR COSTS THAN THE ALTERNATIVE, BASED ON EXPANDED TICARRS. IN PRESENT VALUE TERMS, THIS ALTERNATIVE IS $144.1M CHEAPER, A SAVINGS OF 31%.

COST TO UPGRADE TICARRS

EXPANDED LINES OF CODE	
C-E	56,176
TRAINING	178,830
PERSONNEL	51,774
CEMS	282,066
AUTOMATED FORMS	28,169
SBSS	295,922
TOTAL LOC	892,937

UNEXPANDED LINES OF CODE	
C-E	21,291
TRAINING	49,040
PERSONNEL	18,762
CEMS	124,749
AUTOMATED FORMS	10,321
SBSS	126,200
TOTAL LOC	350,363

- CONTRACTOR COST:
  350,363 LINES OF CODE AT 1HR/LINE = 350,363 HOURS
  350,363 @ $50.00 / HR = $17,518,150
- TOTAL COST TO AIR FORCE:
  CONTRACTOR COST + AIR FORCE COSTS = TOTAL COST TO AIR FORCE
  $17.5M + .5 (17.5)M = $26,250,000

IV. DYNAMICS RESEARCH CORPORATION

A. FORWARDING LETTER

A copy of the forwarding letter from Albert Rand, President and CEO, Dynamics Research Corporation (DRC), appears on pages V-2 through V-5 of this document.

DYNAMICS RESEARCH CORPORATION
60 FRONTAGE ROAD, ANDOVER, MASSACHUSETTS 01810 TEL. 508/475-9090

July 23, 1993

Mr. Stanley A. Horowitz
Institute for Defense Analyses
1801 N. Beauregard Street
Alexandria, Virginia 22311-1772

Dear Mr. Horowitz:

I appreciate the opportunity you provided to review the draft version, "A Comparison of Air Force Data Systems." Your team did an excellent job in synthesizing a vast amount of information in a relatively short time on a very complex subject.

In providing a copy of the report to us, Mr. David Dore requested that we review the report for completeness, correctness, and accuracy. Enclosed you will find the comments that we believe to be substantive to an objective assessment of the information contained in the report. These should not be interpreted as being inclusive of all our comments or critical of your efforts.

For convenience, we have organized our comments into two categories. All of our comments relating to cost are attached to a cost element spread sheet depicting a comparison of CAMS/REMIS, and TICARRS costs (Tab A). In some cases, these comments also relate to the narrative discussion in the report. The second category of comments relates to the contents of the remainder of the report (Tab B). Our comments relate primarily to errors of fact, cases of incomplete information, and omissions which materially impact the conclusions and create a negative impression inconsistent with the actual facts. Our objective was not to critique every word or the style in which the report was written. Tab C is a copy of the MOA for the Operational Assessment.

Operational Assessment

My personal review of the report did raise several issues concerning the methodology used in the study and the logic of the arguments presented that are of concern to me. I would like to share these with you.

My first concern relates to the Operational Assessment data. Contrary to popular belief this was not a 6 week test and it was far from being an objective assessment. The conclusions in the Air Force report are inconsistent with the Air Force's own experience where over 2,350 F-15, F-16, and F-117 aircraft flying over 6,283,200 hours have been successfully supported by TICARRS. We have reviewed the Air Force assessment report and we have

identified and sent a letter to the Air Force identifying a few of the major errors of fact which have a significant bearing on an objective assessment of that test. From reading the IDA report, it appears that IDA may have carried forward a number of these errors of fact. Before we can agree on the facts of your report, we need to reach agreement as to the relevant facts of the Assessment. It is my hope that at the July 28 meeting we can resolve these issues.

Increasing the Scope of TICARRS

A number of caveats appear throughout the report that express doubts as to our and TICARRS ability to absorb the scope of the inventory supported by CAMS in a timely fashion and retain high data quality. I do not agree with this subjective assessment based on history. The concurrency of the world wide F-16 activation schedule and the multiple aircraft configurations supported remain unprecedented in DOD. DRC demonstrated the ability to rapidly activate TICARRS, load and validate data bases, make software modifications, sustain operations, and deal with a dynamic and changing schedule - successfully meeting contract requirements at a fixed price. Regarding data quality, as observed by IDA, the design of TICARRS inherently provides software and procedural routines and edits that insure high data quality. This capability is not sensitive to inventory size. Certainly, Air Force wide activation of TICARRS will be challenging, but we have already met the challenge with three of the most complex weapons systems and associated logistics environments in DOD. There is no reason to believe DRC and TICARRS are not up to the challenge.

Methodology

A functional comparison of CAMS/REMIS to the TICARRS-92 baseline (direct connectivity and data base) would have highlighted a significant and critical difference which distinguishes TICARRS from CAMS/REMIS today and for the future. TICARRS was designed from the outset to be an integrated, on-line weapons system management information system tying together all users (base, depot, headquarters, program offices, and contractors) with access to timely and accurate information to manage the logistics and engineering support of complex weapon systems. Although CAMS represents an advance over its predecessor MMICS, CAMS was designed as a data collection system with each base being a stove pipe of local data. REMIS was designed as a data collector being fed from various other data systems. The operational assessment at Seymour-Johnson clearly did not demonstrate the full capabilities of an integrated, real time fleet wide information system capability.

TICARRS may have been ahead of its time because it was designed to support a proactive management by weapon system management philosophy, with fleet-wide and asset-wide visibility. This management strategy is now being espoused in various DOD policies. In this respect, TICARRS represents the most advanced and unique capability of its type within DOD and represents the most capable,

advanced capability to serve as baseline for the incremental development of the next generation of weapons system information systems.

Data Quality

Additionally, this approach and the associated costing methodology do not assess the cost and the design issues associated with CAMS and REMIS meeting or exceeding the data quality capabilities of TICARRS. The report notes that TICARRS does not have a requirement for data accuracy and validity, but that CAMS and REMIS do thereby creating the impression that this is a deficiency in TICARRS. These requirements only address computational precision and not validity in terms of measuring the quality of the data in the data base. These requirements are not a measure of what is missing or the accuracy of what is there.

It matters little how many digits to the right of the decimal point the algorithm will calculate if the data is unreliable to begin with. This is not an insignificant issue because TICARRS data was considered so complete and accurate that contractors accepted it for warranty determination purposes. General Dynamics considered TICARRS data to be so timely and accurate that they tied TICARRS data as an input to the GD Quality Assurance Report process. This program called Project Bluestreak was extremely successful in correcting manufacturing defects.

Cost

The question of cost raises a question of logic in the analysis. Your report correctly noted the adequacy of the TICARRS cost data base as well as noting the uncertainty of the supporting CAMS estimate. Unfortunately, the report treats each point estimate with the same degree of certainty even though the report states "past costs was used to assess the realism of estimates of future costs." The presentation of cost presents a misleading picture of the risks associated with each alternative. DRC's contract history demonstrates our ability to consistently deliver on time and on budget. I do not believe the record supports such performance with CAMS and REMIS. For completeness, I believe the report should include in its discussion the track of prior year costs, the track of estimates versus actuals, and the lower risk inherent in TICARRS estimates.

Further, the cost estimate penalizes the TICARRS alternative with the nonrecurring cost to clean-up the CAMS and REMIS data bases to TICARRS quality levels. Clearly, there is a need to clean-up the CAMS/REMIS data base before conversion to achieve the benefits of high quality data. This cost should be a charge to CAMS/REMIS, not TICARRS.

TICARRS/CAMS Transition

One additional issue is of concern. IDA attempted to test the hypotheses that weapon system management information management systems affect the operational and logistics support environment and that a specific change from one information system to another could be linked to various logistics indicators.

Based on the limited data provided in the report, I do not believe the assertion that the conversion from TICARRS tc CAMS did not impact weapon system performance. For this conclusion to be true, we have to believe that the significant and documented deterioration in the quality of the CAMS/REMIS data base upon conversion had no impacts in the logistics community. However, we know from the large number of testimonial messages from the F-16 logistics managers and the contractors that it had a significant impact. Additionally, bad actor studies by RAND and DRC have demonstrated the significant payoff resulting from high quality data. Further, this conclusion runs counter to IDA's rationale for a data system that provides over 90-100% accuracy. If quality data were not a significant cost driver impacting weapon system performance, the Air Force would not have initiated the RIPIT project to improve the quality of data. The gross metrics selected for hypothesis testing are driven by a large number of diverse variables and to suggest that MMH/FH and MTBF should be the sole indicators of the impact of the conversion to CAMS oversimplifies the issue. I am not aware of any data that has demonstrated a direct causal relationship of MMH/FH and MTBF as being the only determinants of weapon system performance. I suggest you delete this discussion from the report.

We appreciate the opportunity afforded us to comment on your excellent study, and we look forward to the meeting on Wednesday, July 28th.

Sincerely,

DYNAMICS RESEARCH CORPORATION

Albert Rand
President and CEO

B. COMMENTS ON COSTS

DRC Comments:

A copy of the comments from DRC on costs (referred to as "Tab A" in the forwarding letter) appears beginning on page V-8 of this document. The page numbers in both the DRC comments and the IDA responses refer to page numbers in the review version of IDA Paper P-2863.

IDA Response:

1. Page VII-1, paragraph 6: We applied the 1,920 hours equally to all systems and used generic labor rates to protect proprietary information.
2. Page VII-2, Section A, Cost Estimate for CAMS: Noted.
3. Page VII-5, Section A1b, paragraph 4: We believe current technology will support the interface and that we have provided sufficient resources for it.
4. Page VII-8, Section A2e, paragraph 4: We have revised our cost estimates to include 6 data base maintenance people and 4 data base management people at Gunter SSC. Costs for data base managers at base level are included under 2.3.2, Base Reps. Assistance provided by UNISYS personnel at SSC is included under contractor labor.
5. Page VII-16, Section C, paragraph 1: We have revised our schedule estimates in light of the MAISRC requirement, and our best estimate for implementing TICARRS is four years.
6. Page VII-19, Section C1b, paragraph 1: Noted. We stand by our estimate.
7. Page VII-21, Section C1b, paragraph 8: Noted. We stand by our estimate.
8. Page VII-24, Table VII-6: We agree with the comment on tactical missiles and have modified the report to reflect this information. We note the comments on simulators/trainers and the various models, but we stand by our estimate.
9. Page VII-23, C1d: Noted. We stand by our estimate. We assume that there will be weapon-system-specific information in the manuals. Also, the manuals will reflect enhancements in functionality.
10. Page VII-26, Section C1f1: We agree and have modified the report to reflect this information.
11. Page VII-26, Section C1f2: Noted.
12. Page VII-27, Section C1f3: Noted. We stand by our estimate.

13. Page VII-27, Section C1f4: Noted. We stand by our estimate. We expect that there will be additional DIREPs during deployment. This category reflects those DIREPs.

14. Page VII-27, Section C1f5: Noted. We stand by our estimate.

15. Page VII-28, Section C2a1: Noted. We applied the same percentage across all three systems.

16. Page VII-28, Section C2c: We applied the same labor hours per year across all three systems.

17. Page VII-29, Section C2d, paragraph 1: We agree and have modified the report to reflect this information.

18. Page VII-30, Section C2e1, paragraph 2: We applied the same criteria across all three systems.

19. Page VII-30, Section C2e2: We agree and have modified the report to reflect this information.

20. Page VII-30, Section C2e3: We stand by our estimate, which used the same criteria across all three systems.

21. Page VII-30, Section C2e4: Noted.

22. Page VII-31, Section C4: We agree and have modified the report to reflect this information.

23. Page VII-31, Section D1, paragraph 3: We agree and have modified the report to reflect this information. In the final report, we have treated all three systems the same.

24. Page VII-33, Table VII-10: Noted.

25. Page VII-36, Table VII-11: We agree and have modified the report to reflect this information.

RESPONSE TO IDA "DRAFT" REPORT - COSTS

1. Page VII-1, paragraph 6

The report uses 1920 hours in its cost analysis. DRC charges the government 1820 hours per year. Our Andover average burdened labor rate is $81,445 per year and the Field Rep burdened labor rate is $54,000 per year. This becomes significant for the period of the study.

2. Page VII-2, Section A, Cost Estimate for CAMS

DRC was upfront with its cost data and we are concerned that some data for CAMS costs were not made available in time for the publication of the draft IDA report. This creates a degree of uncertainty because now there is an awareness of what the target cost have to be.

3. Page VII-5, Section A1b, paragraph 4

The feasibility of providing an enhanced editing capability with immediate communications between CAMS and REMIS has not been addressed. Will current technology support that type of interface?

4. Page VII-8, Section A2e, paragraph 4

DRC questions the requirement for only four experienced database managers, all located at SSC. Given the inherent problems associated with providing support for this type of a remote database, it seems logical that more personnel than that required for TICARRS would be appropriate. DRC's own estimate for database managers is 7-8. The cost estimates for experienced DBMs at SSC seems excessively low. DRC does not see any costs for assistance provided by UNISYS personnel at SSC. Where are the costs for database managers at the base level included?

5. Page VII-16, Section C, paragraph 1

DRC believes that the scheduled implementation of TICARRS-92 for the entire Air Force can be accelerated by several months. Cost differentials for the DRC proposed implementation schedule are included as part of the DRC costing. DRC would assume a contract start date of January 1, 1994. We would agree with the IDA comment that six months would be spent in enhancing the functionality of TICARRS-92 to take over the functions of CAMS/REMIS. The enhancement period would be January 1-June 30, 1994. DRC also agrees that the TICARRS database would be initialized for one weapon system, the

F-117A, and CAMS data from one base, Holloman AFB, NM, would be loaded onto TICARRS-92. This would be accomplished by July 1, 1994. The OT&E would then occur during July through September 1994 at Holloman AFB for the F-117A. During the period of time from January 1 through September 1994, DRC would begin the "Activities required for Weapon System Initialization" and the "Activities required for Unit Activation". Weapon system initialization would include activities such as determining weapon system peculiar data, i.e. WUC, Configuration items, Job standards, etc. Unit activation initialization would include completing a site survey and obtaining information such as serial numbers, TCTO header information, etc. Sufficient weapon systems and bases would be completed by October 1, 1994 to support training those locations and weapon system personnel. As training is proceeding, the remaining weapon systems and bases would be initialized with all initialization and training completed not later than September 30, 1995. This schedule would allow the shut-down of CAMS/REMIS several months earlier than the IDA report anticipates at a substantial cost savings to the Government.

6. Page VII-19, Section C1b, paragraph 1

Functional Enhancements. DRC has a well established track record of completing all efforts within budget when they are estimated at the level of detail provided for these enhancements. DRC will have PQDR completed before Oct 1993 and the CEMS interface requirement should only include software to support an interface with CEMS and not to replicate all CEMS processing. This is estimated as Option 2. Therefore, we have reduced the estimate to a total of 15,134 manhours or $.8m using DRC's Andover labor rate.

7. Page VII-21, Section C1b, paragraph 8

System Software Interfaces. Of the thirteen systems listed as having interfaces with REMIS, eight receive data from REMIS, one provides data to and receives data from REMIS and one, DO87F, apparently has no interface with REMIS. G001C will be replaced by TICARRS-92, because depot users will input their data on-line into TICARRS-92. Of the remaining system interfaces, TICARRS-92 will be required to generate nine output files and process data from seven input files. Both the generated files and the input files are straight forward extracts of data from the data base or the loading of reference data or other types of data (status, utilization, and MDC data from G081) which TICARRS-92 can already load. DRC's estimate of $560,000 for developing the interfaces provides for approximately 800 manhours per file. As our view of the actual requirements becomes

clearer, it appears to be an estimate that we would have great difficulty exceeding.

8. Page VII-24, Table VII-6

DRC's original estimates by weapon system included G&A and Profit. The summary costs included in the 10 year cost projections excluded the G&A and Profit values.
DRC has added costs to activate the B2 on TICARRS.
DRC has completed additional research on the issue of activating Tactical Missiles on TICARRS. Everyone we have contacted has come back with basically the same information. Information on Tactical Missiles is reported using the Tactical Missile Reporting System (TMRS). Personnel responsible for the Tactical Missiles do not have CAMS terminals. When they need to order parts for the missile trailers, they may go to a shop that has a CAMS terminal and use the CAMS/SBSS interface. If they need some support from a backshop, they may use a CAMS terminal to generate a WCE using a generic WUC. Personnel and Training Management data is loaded into CAMS for these personnel. Providing for the above mentioned requirements can be accomodated in TICARRS without any additional cost. The first two requirements would impact operational cost if they happened frequently, but we have been told that is not the case. Since we plan an automated load of all MPT data, the volume of records loaded for a unit will not impact the costs. Therefore there are no additional costs included for Tactical Missiles.
Simulators/Trainers were already included in DRC's cost projections as part of the weapon system and unit activation costs.
DRC's previously provided weapon system estimates already take into account the various models and mission configuration requirements. For example, with the C130 the mission/debrief is rated with a complexity of 5 because we will need to make modifications to debrief.
DRC does not agree with the 20% delta for the Block/Models for the F-16 and F-15. All the necessary information already resides in TICARRS. The cost estimates for initializing each weapon system provided by DRC took into account the various models and mission configuration impacts. Also, the cost estimates provided by DRC included fully burdened labor plus G&A and Profit. For the F-16 weapon system, the Block 40 and 50 aircraft are the equivalent of adding additional models of aircraft. These blocks have their own Work Unit Code (WUC) and test station manuals. Block 10 aircraft are A and B models. Block 10,20, and 30 aircraft all use the same test stations. All of the basic information (Organization structure, Equipment Ids, WUCs, Part Numbers, Configuration Templates, Phase Dock Inspection Decks, etc) needed to activate the entire F-16 weapon

system have already been loaded to the TICARRS data base. The bulk of the hours estimated for the activation is to verify that the information is correct as loaded and to load any additional information, such as TCTOs, JSTs, and AMOC information to the system. A particular TCTO may relate to one or more models, but the fact that it does, will not impact the weapon system initialization cost. The volume of data is what determines the initialization costs.
For the F-15 weapon system, costs have been included for building configuration templates for models A, B, C, and D. They have already been built for the E model as part of the Operational Assessment at SJAFB. The data load for the F-15 weapon system is actually estimated higher than for the F-16 because there is less data loaded for the F-15, even though there are more F-16 models.
For the C-130 weapon system, tankers, helicopters, etc., DRC can identify no reason to add additional costs for each type of aircraft. DRC stands by its original estimates for all these weapon systems.

9. Page VII-23, C1d

The costs for producing and distributing the initial release of the user manual is not related to the cost of adding additional functionality, establishing interfaces with other systems, and initializing weapon systems. It is strictly a factor of the number of copies that have to be produced and distributed. DRC stands by its original estimate of $600k.

10. Page VII-26, Section C1f1

DRC agrees with the manhour estimate but the Andover Labor rate should have been used, not the Field Rep rate.

11. Page VII-26, Section C1f2

DRC stands by its original estimate.

12. Page VII-27, Section C1f3

The cost of the site representatives that will be used for the user training are costed by DRC at $54,000 per year. Therefore, the totals for this section should be $1.84M.

13. Page VII-27, Section C1f4

DIREPS are considered by DRC to be a part of the O&M costs. The charge for software maintenance during the same period of time includes anticipated cost for DIREP resolution.

14. Page VII-27, Section C1f5

This cost should not be included as an hourly cost. The short-term support would be provided by a site representative already on the DRC payroll. The only possible cost in this category would be per diem costs at a rate of $100.00 per day. That rate should be by base and not by unit. The cost of this short-term support should be $228,900 rather than $1.1M.
$100 per day x 21 days x 109 bases = $228,900.

15. Page VII-28, Section C2a1

The contractor provides management for his program. The SPO staff can be much smaller than if it was managing an organic program.

16. Page VII-28, Section C2c

The 1920 hours per year are too high. DRC costs for site representatives are calculated at an average of $54,000 per year. Based upon those costs, the User Support costs should be as follows:
FY 1994 - 34 site representatives
FY 1995 - Approximately 67 site representatives
FY 1996 thru FY 2003 - 112 site representatives

17. Page VII-29, Section C2d, paragraph 1

The communications costs should be recalculated:
Costs: (based upon SPRINT rates)
- Upgrade from 9.6 Kbps to 19.2 KBPS is $750 per line, a one-time charge per line.
  $750 x 57 = $42,750
- The cost of a 19.2 Kbps line is $1145 per month.
- The cost of a 56 Kbps line is $1750 per month.

The annual communications costs should be:
- 107 sites x $1175/month x 12 months = $1,470,180
- 2 56 Kbps lines at $1750/month x 12 months = $105,000
- Total projected annual Communications Costs = $1,554,930

Lines to RPC's:
These costs should be eliminated because they are costed under the Comm charges (2.4.1).

18. Page VII-30, Section C2e1, paragraph 2

The estimation criteria of 25,000 LOC per maintainer has no basis from the DRC perspective. When an organization is given responsibility for both operating and maintaining a software application the staffing requirements cannot be dependant solely on the

application lines of code. The staff requirements for an online system are not the same as for a batch fed system. An on-line system requires personnel dedicated to quickly responding to DIREPs and other personnel dedicated to monitoring the performance of the data base and the transaction processor. A batch fed system does not have the same response time requirements and therefore a smaller staff can be assigned to these functions. A batch fed system requires, however, a staff to ensure that all data is received and processed, a staff which is not needed with an on-line system. Therefore estimating staff requirements must consider the staffing experience when TICARRS was an on-line system. Also, TICARRS LOC will not increase significantly as each weapon system is added so DRC staff estimates cannot be based solely on LOC.
This section includes all costs associated with ensuring that the TICARRS application operates well. It includes data base administrators and TP administrators, as well as personnel for DIREP support, software improvements, and production support.

19. Page VII-30, Section C2e2

Database Management for TICARRS includes a variety of user support activities, some of which do not seem to be accounted for in the REMIS and CAMS estimates. Software QA, Help functions and documentation maintenance are included, but the costs for updating reference type data do not seem to be included for CAMS and REMIS.

20. Page VII-30, Section C2e3

Based on our past experience software maintenance rarely results in a need to update documentation. Therefore, we have revised this to two percent.

21. Page VII-30, Section C2e4

Travel is not required for training. It is primarily used for Program Management Reviews and coordination meetings with both Air Force and Field Rep personnel.

22. Page VII-31, Section C4

G&A Plus Profit. This should be calculated on all contractor costs, but not on government costs. DRC's estimate for this category has included only contractor items.

23. Page VII-31, Section D1, paragraph 3

Why are facilities costs only included for the TICARRS PMO? They should probably be included for all military

and civilian personnel.

24. Page VII-33, Table VII-10

Task 2.5.1 is caluculated incorrectly. Tasks 3.5.5 should be reduced consistent with 2.5.1. Tasks 2.3.1 and 3.5.4 should also be reduced as the number of bases and number of software maintainers are reduced. DRC's revisions to this table are attached.

25. Page VII-36, Table VII-11

REMIS software maintenance requirements should decrease similar to that estimated for CAMS. DRC's revisions to this table are attached.

DRC is also attaching revisions for Tables VII-4 and VII-9.

		1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	Total	IDA Total	Delta
1.0	Non-recurring Costs													
1.1	Hardware													
1.1.1	Mainframes	6.60	6.60					1.75	1.75			16.70	16.70	0.00
1.2	Software													
1.2.1	Application Software													
	Funct'l Enhancements	0.80										0.80	1.61	-0.81
	System Interfaces	0.56										0.56	2.25	-1.69
1.2.2	Database Initialization	2.35	3.44									5.80	9.88	-4.09
1.2.3	Documentation (10%)	0.30	0.30	0.00								0.60	1.37	-0.77
1.3	Communications													
1.3.1	Hardware	0.05										0.05	0.05	0.00
1.4	Training/Unit Activ													
1.4.1	Site Surveys	0.24	0.24									0.47	0.36	0.11
1.4.2	Load CAMS Data	1.39	1.39									2.79	5.06	-2.27
1.4.3	User Training		1.84	0.00								1.84	2.22	-0.38
1.4.4	Resolve DIREPs		0.00	0.00								0.00	4.84	-4.84
1.4.5	Short-Term Support		0.00	0.00								0.00	1.10	-1.10
1.4.6	Travel (Training)		2.10	0.00								2.10	1.10	1.00
1.4.7	T&L (Short-Term)		0.23	0.00								0.23	0.56	-0.33
1.5	Travel (Unit Activation)		0.24									0.24	0.00	0.24
	Subtotal Non-recurring	12.30	16.38	0.00	0.00	0.00	0.00	1.75	1.75	0.00	0.00	32.18	47.10	-14.92
2.0	Recurring Costs													
2.1	Program Management													
2.1.1	Government *	1.36	2.19	1.56	1.56	1.56	1.56	1.56	1.56	1.56	1.56	16.07	18.84	-2.77
2.1.2	Contractor	0.65	1.04	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	7.65	8.97	-1.32
2.2	Computer Operations													
2.2.1	Central Computer													
	Operational Staff	0.70	1.40	2.22	2.22	2.22	2.22	2.22	2.22	2.22	2.22	19.86	19.86	0.00
	H/W, S/W, Utilities	1.89	1.89	1.89	1.89	1.89	1.89	1.11	1.11	1.11	1.11	15.78	15.78	0.00
2.2.2	Base Comm Operation *													
	CIV & Mil Personnel		7.65	11.38	11.38	11.38	11.38	11.38	11.38	11.38	11.38	98.69	91.13	7.56
	H/W, S/W, Utilities	0.80	2.40	2.40	2.40	2.40	2.40	2.40	2.40	2.40	2.40	22.40	21.60	0.80
2.2.3	OCONUS Operations *													
	CIV & Mil Personnel	0.74	2.86	4.46	4.46	4.46	4.46	4.46	4.46	4.46	4.46	39.28	36.33	2.95
	H/W, S/W Utilities	0.25	0.75	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	8.84	8.35	0.49
2.3	User Support	1.84	3.58	6.05	6.05	6.05	6.05	6.05	6.05	6.05	6.05	53.80	68.45	-14.65
2.4	Communications													
2.4.1	Comm Charges	0.85	1.58	1.58	1.58	1.58	1.58	1.58	1.58	1.58	1.58	15.07	15.88	-0.81
2.4.2	Lines to RPCs	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.99	-1.99
2.5	Software Maintenance													
2.5.1	Application Software	3.20	4.05	4.27	4.27	4.27	4.27	4.27	4.27	4.27	4.27	41.41	41.45	-0.04
2.5.2	Database Management	1.30	1.93	1.93	1.93	1.93	1.93	1.93	1.93	1.93	1.93	18.67	11.16	7.51
2.5.3	Documentation (2%)	0.06	0.08	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.83	2.63	-1.80
2.6	Training & Travel	0.20	0.30	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	3.30	5.52	-2.22
	Subtotal for Recurring	13.84	31.71	39.90	39.90	39.90	39.90	39.12	39.12	39.12	39.12	361.66	367.95	-6.29
4.0	G&A Plus Profit	3.45	4.84	2.87	2.87	2.87	2.87	3.01	3.01	2.75	2.75	31.28	59.15	-27.87
	Total	29.59	52.92	42.77	42.77	42.77	42.77	43.89	43.89	41.87	41.87	425.11	474.76	-49.65
	Non-contractor (* items)	3.15	15.85	20.78	20.78	20.78	20.78	20.78	20.78	20.78	20.78	185.28		

IDA - Alternative 2 - Table VII-9											
	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	Total
CAMS	48.06	34.65	20.49	0.00	0.00	0.00	0.00	0.00	0.00	0.00	103.20
REMIS	10.66	10.66	10.66	0.00	0.00	0.00	0.00	0.00	0.00	0.00	31.98
TICARRS	29.51	51.40	52.54	48.73	48.73	48.73	49.85	49.59	47.84	47.84	474.76
Total	88.23	96.71	83.69	48.73	48.73	48.73	49.85	49.59	47.84	47.84	609.94
Present Value	88.23	92.72	76.93	42.95	41.18	39.48	38.72	36.93	34.16	32.75	524.06

DRC - Alternative 2 - Table VII-9											
	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	Total
CAMS	45.74	18.81	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	64.55
REMIS	9.72	6.49	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	16.20
TICARRS	29.59	52.92	42.77	42.77	42.77	42.77	43.89	43.89	41.87	41.87	425.11
Total	85.05	78.22	42.77	42.77	42.77	42.77	43.89	43.89	41.87	41.87	505.86
Present Value	85.05	74.99	39.32	37.7	36.14	34.65	34.09	32.69	29.90	28.66	433.18

		IDA				DRC				
		1994	1995	1996	TOTAL	1994	1995	1996	TOTAL	DELTA
1.0	Non-recurring Costs									
1.1	Hardware									
1.1.1	CAMS share of RPC H/W									
1.2	Software									
1.2.1	Application Software									
	Approved CRSD									
	Enhanced Editing									
	New Weapons/Equip									
	System Int and Test									
1.2.2	Initialize Database									
1.2.3	Documentation									
1.3	Communications									
1.4	Training									
	Non-recurring Sub-Total									
2.0	Recurring Costs									
2.1	Program Management									
2.1.1	Government	0.36	0.27	0.19	0.82	0.16	0.09	0.00	0.25	-0.57
2.2	Computer Operations									
2.2.1	RPC Operations									
	Civ and Mil Personnel	1.22	0.81	0.40	2.43	1.22	0.40	0.00	1.62	-0.81
	H/W, S/W, Utilities	3.59	2.15	1.08	6.82	3.59	1.08	0.00	4.67	-2.15
2.2.2	OCONUS Operations									
	Civ and Mil Personnel	10.02	7.52	5.01	22.55	10.02	5.01	0.00	15.03	-7.52
	H/W, S/W, Utilities	2.66	1.99	1.33	5.98	2.66	1.33	0.00	3.99	-1.99
2.2.3	Base Comm Operations									
	Civ and Mil Personnel	16.88	11.25	5.62	33.75	16.88	5.62	0.00	22.50	-11.25
	H/W, S/W, Utilities	8.00	6.00	3.00	17.00	8.00	3.00	0.00	11.00	-6.00
2.3	User Support									
2.3.1	Field Help Group	0.17	0.17	0.17	0.51	0.17	0.09	0.00	0.26	-0.26
2.3.2	Base Representatives									
2.4	Communications									
2.4.1	RPC H.S. Base Links	0.568	0.749	0.77	2.09	0.568	0.770	0.00	1.34	-0.75
2.4.2	High Speed REMIS Link									
2.5	Software Maintenance									
2.5.1	Application Software	3.11	2.33	1.55	6.99	1.10	0.65	0.00	1.75	-5.25
3.5.4	Software Maint Operations	0.52	0.52	0.52	1.56	0.52	0.26	0.00	0.78	-0.78
3.5.5	System Int and Test	0.65	0.65	0.65	1.95	0.55	0.33	0.00	0.88	-1.08
2.5.2	Database Management	0.17	0.13	0.09	0.39	0.17	0.10	0.00	0.27	-0.12
2.5.3	Documentation	0.09	0.06	0.09	0.24	0.08	0.05	0.00	0.12	-0.12
2.6	Training & Travel	0.07	0.05	0.03	0.15	0.06	0.05	0.00	0.11	-0.04
	Recurring Costs Sub-Total	48.08	34.65	20.50	103.23	45.74	18.81	0.00	64.56	-38.67
	Total Costs	48.08	34.65	20.50	103.23	45.74	18.81	0.00	64.56	-38.67

		IDA				DRC				
		1994	1995	1996	TOTAL	1994	1995	1996	TOTAL	DELTA
1.0	Non-recurring Costs									
1.1	Hardware									
1.1.1	Mainframes									
1.2	Software									
1.2.1	Application Software									
	Improve Performance									
	Improve REMISTALK									
1.2.2	Initial Database									
1.2.3	Documentation									
1.3	Communications									
1.4	Training									
	Subtotal Non-recurring									
2.0	Recurring									
2.1	Program Management									
2.1.1	Government	0.78	0.78	0.78	2.34	0.70	0.45	0.00	1.15	-1.19
2.1.2	Contractor	0.37	0.37	0.37	1.11	0.35	0.23	0.00	0.58	-0.53
2.2	Computer Operations									
2.2.1	Central Computer									
	Operational Staff	1.88	1.88	1.88	5.64	1.88	1.41	0.00	3.29	-2.35
	H/W, S/W, Utilities	1.08	1.08	1.08	3.24	1.08	0.81	0.00	1.89	-1.35
2.2.2	At ALCs									
	Operational Staff	0.26	0.26	0.26	0.78	0.26	0.20	0.00	0.46	-0.33
	H/W, S/W, Utilities	0.31	0.31	0.31	0.93	0.31	0.23	0.00	0.54	-0.39
2.3	User Support	0.92	0.92	0.92	2.76	0.78	0.46	0.00	1.24	-1.52
2.4	Communications	0.16	0.16	0.16	0.48	0.16	0.12	0.00	0.28	-0.20
2.5	Software Maintenance									
2.5.1	Application Software	3.46	3.46	3.46	10.38	2.94	1.73	0.00	4.67	-5.71
2.5.2	Database Management	0.58	0.58	0.58	1.74	0.58	0.35	0.00	0.93	-0.81
2.5.3	Documentation	0.20	0.20	0.20	0.60	0.17	0.10	0.00	0.27	-0.33
2.60	Training & Travel	0.42	0.42	0.42	1.26	0.38	0.29	0.00	0.67	-0.59
	Subtotal for Recurring	9.27	9.27	9.27	27.81	8.54	5.70	0.00	14.24	-13.57
2.0	G&A Plus Profit	1.39	1.39	1.39	4.17	1.18	0.79	0.00	1.96	-2.21
	Total	10.66	10.66	10.66	31.98	9.72	6.49	0.00	16.20	-15.78

C. GENERAL COMMENTS

DRC Comments:

A copy of the general comments from DRC (referred to as "Tab B" in the forwarding letter) appears beginning on page V-23 of this document. The page numbers in both the DRC comments and the IDA responses refer to page numbers in the review version of IDA Paper P-2863.

IDA Response:

1. Page I-1, Section a, paragraph 7: Very few officers participated in the surveys: however, we agree and have modified the report to reflect this information.
2. Page II-8, Section 2, paragraph 1: We agree, although the CAMS/REMIS PMO indicates that development of CAMS user access to REMIS through CAMS terminal is under way. No credit has been given for this activity at this time.
3. Page II-9, Section C1, paragraph 1: We agree and the report has been modified to reflect this information.
4. Page II-11, section 2, paragraph 2: Chapter II has been revised.
5. Page II-11, section 2, paragraph 3: Noted, but this is more extensive information than we wanted to put in Chapter II.
6. Page II-12, Section 3c, paragraph 1: Systems in development are not prominently noted in the IDA report.
7. Page III-2, Section 1, paragraphs 2, 3, 4: Noted. We have treated the functions of the systems more extensively in Chapter V.
8. Page III-3, Section 2, paragraph 2: Noted.
9. Page III-5, Section a, paragraph 1: Noted. The relevant section discusses requirements only.
10. Page III-9, Section 5b, paragraph 4: Noted. We have addressed the extent of effort necessary later in the report.
11. Page III-10, Section d, paragraph 3: We agree and have modified the report to reflect this information.
12. Page III-12, Section B, paragraph 3: We have considered past records on meeting cost and schedule objectives in making our estimates.
13. Page IV-6, Section E: We have included a discussion of the Operational Assessment and IDA's role in it, but we do not believe that the MOA needs to be appended. It is part of the public record.

14. Page IV-9, Section 4, paragraph 2: We agree and have modified the report to reflect this information.

[Note: Number 15 was omitted from DRC's numbering scheme.]

16. Page V-3/4, Table V-1: Some of these points have been incorporated into the table and others have been dealt with in the text of the final report.

17. Page V-3, Table V-1: The table notes only the active planning and scheduling activities such as is done in CAMS. The text reflects differences in approaches.

18. Page V-3, Table V-1: The table has been modified to reflect this information.

19. Page V-4, Table V-1: The issue is that TICARRS only records the information; it must be entered and changed by the technician. CAMS, through an interface with SBSS, can query the system and have the information automatically retrieved.

20. Page V-4, Table V-1: TICARRS requires a special computer run to trace multiple cannibalizations or one can browse through maintenance history. CAMS provides a query in background to provide the information. The Operational Assessment revealed this inability to track multiple cannibalizations within TICARRS to be a deficiency. The text has been modified to reflect this information.

21. Page V-4, Table V-1: We agree that it supports but does not have an "active" shop scheduling function, which is among DRC enhancements for TICARRS.

22. Page V-4, Table V-1: The report has been modified to reflect this information.

23. Page V-5, Section 3a, paragraph 1: At this time, the deficiency must be noted and its costs estimated.

24. Page V-6, Section 3c, paragraph 1: The report has been modified to reflect this information.

25. Page V-6, Section 3c, paragraph 2: This was difficult at the Operational Assessment, but we agree and the table has been modified to include this information.

26. Page V-8, Section 3g, paragraph 3: The point here is that the technician cannot close the job. TICARRS has not demonstrated the ability to create jobs involving multiple work centers.

27. Page V-8, Section 3g, paragraph 6: The TICARRS ARC does not support the Air Force in the same manner as the ARC in CAMS. This may be a matter of policy and procedures and have little substance beyond reporting, but it was serious enough at Seymour Johnson AFB to warrant using CAMS in place of TICARRS for this function. If the problem were limited to data in one place as indicated in the DRC response, it seems as though DRC and the 4th Wing would have fixed that problem and proceeded to use TICARRS. They did not.

28. Page V-29, Section 3g, paragraph 7: TICARRS does not provide narratives for look Phase, only for fix Phase and TCIs.

29. Page V-10, Section 3g, paragraph 12: TICARRS PQDR capability is limited to the F-16 community and F-16 formats for interface with INFOCEN. The F-15 and F-16 data bases are not standardized in INFOCEN, and changes to TICARRS would be required to interface on other weapon systems. The issue of whether originators can make changes after submission to QA will arise if TICARRS is to support the rest of the Air Force. Thus, the response by DRC is correct but does not negate the necessity of making changes to TICARRS to process PQDRs differently from current capabilities.

30. Page V-10, section 3h, paragraph 2: We disagree.

31. Page V-11, Section i, paragraph 2: TICARRS 92 failed to collect and track all engine maintenance information within the Engine Maintenance shop at Seymour-Johnson even after engine configuration problems were solved. These problems arose at the very end of the assessment. In addition, TICARRS treats on-equipment maintenance as aircraft maintenance attaching LRUs to the aircraft instead of to the engine. Engine management requires that the engine be treated as an end item for all maintenance. When an engine is removed, the LRUs must move with the engine.

32. Page V-11, Section j, paragraph 1: The report has been modified to reflect this information.

33. Page V-11, Section j, paragraph 2: TICARRS requires a special computer run to trace multiple cannibalizations or one can browse through maintenance history. CAMS provides a query in background to provide the information. The Operational Assessment revealed this inability to track multiple cannibalizations within TICARRS to be a deficiency. The engine issue was supposed to be uninstalled to installed engine. The text has been modified.

34. Page V-13, Section ck, paragraph 2: We have been unable to verify this purported problem. Kit status in TICARRS is monitored only if the information is manually entered and manually tracked.

35. Page V-14, Section p, paragraph 2: The report has been modified to reflect this information.

36. Page V-15, Section p, paragraph 4: We agree, and the report has been modified to reflect this information.

37. Page V-16, Section B, paragraph 3: We agree and have modified the report to reflect this information.

38. Page V-17, Section B, paragraph 6: Noted.

39. Page V-21 and Page V-25, Tables V-2 and V-4: We agree and have tried to clarify the discussion in the final report, in the light of the widespread misunderstanding.

40. Page V-21, Section b(1), paragraph 2: Noted.

41. Page V-28, Section c, figure V-6: We discuss this issue in the section on the REMIS test in Chapter V and in Appendix D.

42. Page V-29, Section C1c, paragraph 3: Noted.

43. Page V-32, Section c(3), paragraph 5: Noted.

44. Page V-36, Section f, paragraph 2: We have revised the report to make it consistent.

45. Page V-38, Section a, paragraph 2: The issue here is ease of use not functionality.

46. Page V-38, Section a, paragraph 3: We agree and the report has been modified.

47. Page V-39, Section a, paragraph 4: The issue here is ease of use, not functionality.

48. Page V-47, Section a, paragraph 2 and Page V-49, Section e, paragraph 1: We agree and have modified the report to reflect this information.

49. Page V-49, Section d, paragraph 2: Noted.

50. Page V-52, Section D2, paragraph 1: Noted.

51. Page V-53, Section 2, paragraph 3: There is a significant difference of opinion between the Air Force and DRC about how many DIREPs were related to software. The IDA team has no objective information that all DIREPs have been corrected, and even if we did, a cost must be attached to that process (whether it has been completed or will be in the future).

52. Page V-54, Section D3, paragraph 4: We appreciate the information. We have expanded our discussion of security for all the systems.

53. Page V-54, Section D4, paragraph 2: We considered the TICARRS experience in estimating costs of future expansions.

54. Page vI-4, Section C, bullet 3: We agree and have modified the report to reflect this information.

RESPONSE TO IDA "DRAFT" REPORT - GENERAL

Specific Comments

1. Page I-2, Section a, paragraph 7

All relevent wing personnel were not trained in the direct use of TICARRS. Most supervisors and officers did not attend any of the training, even though they were asked to participate in the surveys included as part of this report.

2. Page II-8, Section 2, paragraph 1

If REMIS requires a personal computer for access, it is impossible for every Air Force user to have the ability to access REMIS data, since there are relatively few personal computers on each CAMS base.

3. Page II-9, Section C1, paragraph 1

This paragraph states that TICARRS has a deployable capability, but this is not reflected in other tables or capabilities in the report. Based upon requirements provided by the Air Force, DRC developed a deployable capability in support of the F-117A for Desert Shield/Storm. The deployable function enables the user to collect and view maintenance, flight scheduling, and flight debriefing information using a portable microcomputer in a stand-alone environment. Software routines extract data from the mainframe computer and transfer it to the PC to provide validation criteria and historical information for the remote data entry sessions. Communications software provides the capability to automatically download to the mainframe when a communications circuit is available.

4. Page II-11, Section 2, paragraph 2

Field representatives were in place as each base was activated on CDS. Each of the first three bases, Hill, MacDill, and Nellis, had a field representative when they were activated in February, 1982.
The F-15E was not activated until 1989.
TICARRS began to receive organizational-level information from CAMS in August 1988 at Luke AFB, AZ. The conversions from on-line TICARRS to CAMS was not completed until September 1991. Torrejon AB, Spain remained an on-line TICARRS base until the base was de-activated in March 1992.

5. Page II-11, Section 2, paragraph 3

TICARRS provides adhoc query capability through the PLP subsystem of IDS II.

6. Page II-12, Section 3c, paragraph 1

DRC is developing a Squadron Centered Logistics System (SCLS) and Repair-Centered Logistics System (RCLS), both of which are to satisfy the initial requirements of the systems of the future as envisioned by this report.

7. Page III-2. Section 1, paragraphs 2,3,4

Admittedly, developing a framework of functions for comparison of two data systems is not easy. The framework chosen lends bias to the study in that it is basically a statement of the existing capabilities (with two exceptions) of CAMS/REMIS with an additional column containing the capabilities of TICARRS, where they happen to coincide. This suggests another table might be drawn conversely, showing TICARRS as having most of the blocks filled, but that would not be too helpful either. A more evenhanded table is shown in Table V-1, System Function Comparison, Attachment 1, where features demanded and used by the field are shown. It should be emphasized that all the functions of TICARRS came about from customer demand when the customers had to pay specifically for the data system operation plus adding features out of their programs. None has been free gratis to the users.

8. Page III-3, Section 2, paragraph 2

TICARRS(SDS) supported trainers for the F-117A weapon system.

9. Page III-5, Section a, paragraph 1

Although the TICARRS FD does not specify mathematical precision, the size and randomness of the sample is what determines the accuracy. The TICARRS sample size is large enough to accurately predict any of the calculations to the same level of CAMS/REMIS. Unless otherwise instructed, the computer carries out single-precision computations to seven significant figures but the reports rounds, for example for MTBF, to hours and tenths of hours.

- TICARRS mathematical calculations can be accomplished 100% accurate to four positions of the decimal point if the user specifies it as a requirement.
- Data is always edited for 100% of the criteria specified.
- Transmitted data undetected error rate is

2.5 x 10(-8) and is automatically corrected by the SPRINT network.
- TICARRS does all the REMIS specified Data Validity edits, except that for data entered on-line, all edits are accomplished at the source.
- Statistical confidence limits have been calculated and displayed for output products in the past and could be in the future whenever the user specified it as a requirement. 90% confidence bounds were calculated for MTBF and MMH/FH for the F-16 until the weapon system reached a total of 100,000 flying hours.

10. Page III-9, Section 5b, paragraph 4

Over the years, DRC has gained considerable experience interfacing with other systems both in support of TICARRS requirements and for other systems. Since we are experienced with establishing interfaces, we know the questions to ask and have developed workable approaches to successfully working interface issues. We have already been through the learnng curve, which we agree can be very steep for software developers who have not been through the process several times. The elapsed time for establishing working interfaces can be lengthy, but the manhours expended does not need to be extensive, provided an organizations experience can be drawn upon.

11. Page III-10, Section d, paragraph 3

The last sentence of this paragraph is misleading. It leads the reader to believe that any base-level user can access REMIS on part repair histories. Only those users provided access through a personal computer will have access to REMIS. Any TICARRS user has access to part repair histories.

12. Page III-12, Section B, paragraph 3

The report should also include past costs and schedules, estimated and actual, in order to provide an indication of the reliability of future estimates for cost and schedule.

13. Page IV-6, Section E

The MOA (TAB C), for the assessment at SJAFB should be included as an appendix for reference.

14. Page IV-9, Section 4, paragraph 2

It should be pointed out that a substantial percentage of the FDWW's were double reports of the same problem, e.g., the same individual reporting a training problem twice.

16. Page V-3/4, Table V-1

Table V-1 (Attached) compares TICARRS functions with the functions of CAMS/REMIS.

17. Page V-3, Table V-1

TICARRS does provide the capability to schedule maintenance at the Organizational (O) level. The scheduling of maintenance is not done the same way it is done in CAMS. When a pilot reported discrepancy is debriefed, a job control number is created and the discrepancy is printed at dispatch. The dispatcher has the responsibility, as part of his job, to prioritize the maintenance scheduling and schedule maintenance technicians to perform the maintenance.

18. Page V-3, Table V-1

Under serialized part maintenance history and "Bad Actor" identification, the TICARRS column should indicate "LRUs/SRUs".

19. Page V-4, Table V-1

Even without an automated SBSS interface, TICARRS does track the status of parts ordered. However the data must be entered and updated manually.

20. Page V-4, Table V-1

TICARRS does provide cannabilization management using CON801, SCN802 which depicts all relative cannabilization management information, including supply document number. (See Sample Screen Attached)

21. Page V-4, Table V-1

TICARRS does support Shop Production Planning/Scheduling/Control. By recording "Due-ins" at the Intermediate (I) level shop, based upon removals at the flight line, the shop supervisor has the ability to schedule and prioritize the LRU production access the test stations.

22. Page V-4, Table V-1

TICARRS-92 has a deployable information system. (See

Comment 3)

23. Page V-5, Section 3a, paragraph 1

It is confusing to incorporate the transfer of an aircraft from one base or squadron to another, as is noted in the paragraph, with the transfer inspection. As the report states TICARRS moves assets by recording a change in ownership. The scheduling and recording of the actions required for a transfer inspection was quite cumbersome in TICARRS-92 during the operational assessment at SJAFB. However, an improvement has been identified and will be made, based upon an FDWW submitted by and with the approval of the Air Force, to make the scheduling of all maintenance actions a much easier process in TICARRS-92.

24. Page V-6, Section 3c, paragraph 1

The listing of primary users of utilization data should also include Plans & Scheduling because of the large number of inspections based on hours.

25. Page V-6, Section 3c, paragraph 2

The last sentence in this paragraph is incorrect. TICARRS sortie history for the month can be found in several places. CON570, Aircraft History, provides sortie history by equipment ID for any specified date range. CON526, Equipment Status & Utilization, provides sortie history by organization for specified date ranges. An example (Attachment 3) is shown for the 334th FS at SJAFB for the period 1 May 93 through 30 May 93. In addition, TICARRS SORT-SUM query will retrieve sortie histories for periods up to a year.

26. Page V-8, Section 3g, paragraph 3

In TICARRS, the supervisor has the capability, during supervisor's review, to close the job without requiring an install action. Also, TICARRS does allow one work center to create work for another work center via CON 530, On-Equipment Maintenance Reporting.

27. Page V-8, Section 3g, paragraph 6

This paragraph fails to mention that the 4th FW at SJAFB did not use a standard CAMS ARC query for their 14 day records check. TICARRS does have an ARC query used to perform a 14 day records check. At SJAFB, the TICARRS-92 ARC query did not agree with the CAMS ARC query for a particular aircraft. The mismatch was quickly tracked to the fact that four serial numbered items on that particular aircraft had not been linked in the TICARRS-92

database because they had duplicate serial numbers which were transferred from CAMS to TICARRS-92. It should have been the responsibility of the crew chief to determine the correct serial number of the units on his aircraft and link those units in the TICARRS-92 database.

28. Page V-9, Section 3g, paragraph 7

TICARRS does allow the recording of narrative as part of an inspection. This is an important feature of TICARRS which is satisfied by CON530 and CON201, both having unlimited narrative space.

29. Page V-10, Section 3g, paragraph 12

TICARRS PQDR capability is being updated to the latest revision of T.O. 00-35D. However, the current PQDR capability is being used at Air National Guard and Air Force Reserve units without difficulty and provides the ability to handle returns to the depot for credit. Per the Assessment Report published by the Air Force Assessment Team, PQDR was not previewed during the TICARRS-92 preview at SJAFB because the capability would be the same as that existing in TICARRS-87 and wing personnel were satisfied with that capability. However, when the actual on-line data entry period began, although the capability remained the same, the system could not be used because it did not meet their requirements. CAMS includes a feature providing the screening point (QA) with the ability to return the PQDR to the originator for modification or possible deletion. When the TICARRS PQDR capability was designed, both maintenance technicians and QA personnel were on the design team. The QA personnel only wanted the technicians to make the initial entries; they, QA, would take it from there stating that it was their job to ensure that it was correctly filled out before it was submitted. Only the Action Point (at an ALC or SPO) can close a PQDR.

30. Page V-10, Section 3h, paragraph 2

The last sentence should be deleted, unless the report goes into a discussion of the issue of overall depot level reporting.

31. Page V-11, Section i, paragraph 2

To say that TICARRS-92 has no CEMS maintenance reporting function is inaccurate. TICARRS-92 demonstrated its ability to collect and track all engine mantenance information required within the Engine Maintenance Shop. TICARRS-92 did not have the ability to interface this data to CEMS, the responsibility of the Engine Manger

Shop. (per the MOA, CEMS interface was not to be tested)

32. Page V-11, Section j, paragraph 1

This section deals more with SBSS than maintenance. SBSS was NOT to be evaluated at SJAFB, per the MOA.

33. Page V-11, Section j, paragraph 2

TICARRS does provide an audit trail of cannibalizations when parts are cross-cannibalized. Each cannibalization does require the opening of a new work order, but that is In Accordance With (IAW) proper Air Force documentation procedures. Only the document number should move with the part, not the JCN. TICARRS does support engine to engine CANNS via CON800.

34. Page V-13, Section ck, paragraph 2

When initially inputting TCTO data into CAMS, the load screen has a data field that asks if kits are to be ordered. Response is Yes/No. It must be noted that this procedure has not worked for over one year and the process is manually accomplished via AF Form 2001 to base supply. However, kit status can be monitored in TICARRS-92 via CON213, SCN214 and CON645, SCN650.

35. Page V-14, Section p, paragraph 2

TICARRS-92 does have a deployable information capability. (See Comment 3) DRC was able, independently from the F-117A and the Air Force process, to procure a communications link to the Gulf, Qatar, in order to support the F-16 unit deployed from Torrejon AB, Spain, the last on-line direct reporting base to TICARRS. Authorization to connect to the line was denied by HQ TAC/LGQ.

36. Page V-15, Section p, paragraph 4

TICARRS does support a deployment capability, and successfully supported the F-117A during Desert Shield/Storm.

37. Page V-16, Section B, paragraph 3

TICARRS (SDS) supported trainers for the F-117A.

38. Page V-17, Section B, paragraph 6

The list on page 17 appears to be extensive but support

for those functions will be provided by enhancements being made to TICARRS-92.

39. Page V-21 and Page V-25, Tables V-2 and V-4

When comparing the daily transaction data in these tables, the reader will notice the difference between CAMS at 12,188 (a one shift average) and TICARRS at 40,660. Doubling the CAMS number to allow for the typical two shift maintenance schedule gives a daily rate of 24,376, giving a ratio of CAMS transactions to TICARRS of about 60%. Over the years both DRC and HQ Air Mobility Command (AMC) (Ref. Michael Creasy, LGXA, Air Mobility Command, Scott AFB, IL 618-256-5633) have observed that when a base converts to CAMS, the number of reported transactions drops to about 50% of prior levels.

40. Page V-21, Section b(1), paragraph 2

During the fourth week of the SJAFB assessment, a team from Gunter AFB balanced the workload of the DCP's at SJAFB which drastically improved the response time. DRC did not make any workload balance changes at the central computer.

41. Page V-28, Section c, figure V-6

It should be explained that the three modules of REMIS do not interact with each other and the impact that has on the users in reviewing a write-up that contains all three types of information.

42. Page V-29, Section C1c, paragraph 3

There are only two instances where users may enter data which TICARRS considers to be "in error". A maintenance technician may report the removal or installation of a part which TICARRS considers to be not installed on that item or not available for installation because it is installed elsewhere or is showing an overdue inspection. In both instances the technician is informed of the perceived error condition and allowed to override. The supervisor is then required to ensure that the "error" condition is cleared in TICARRS before the maintenance action can be approved.

43. Page V-32, Section c(3), paragraph 5

TICARRS has an integrated database system, meaning each data element is only stored in one place and can be

accessed for any display. The only instance of a requirement to reenter data into TICARRS when moving to a new screen would be when the data element required for

the new screen was not entered on the previous screen. TICARRS prefills any information required to be moved from one screen to the next.

44. Page V-36, Section f, paragraph 2

There is an inconsistency in this paragraph because earlier in the report it was stated that TICARRS would require 3x its current power and it is 4.5x in this paragraph. DRC agrees with the requirement of 3x the current power.

45. Page V-38, Section a, paragraph 2

Add after ...test at Ogden. TICARRS suports "bad actor" program by retaining part/serial history for LRU/SRU at all reporting levels.

46. Page V-38, Section a, paragraph 3

Recommend the last sentence, "REMIS works better for the logistics community", be modified to state, "better than ___", and enter the reference.

47. Page V-39, Section a, paragraph 4

Add a "bullet" to Contractors section:
- TICARRS LRU/SRU "bit/piece history available for analysis and evaluation by engineering for TCTO mod updates.

48. Page V-47, Section a, paragraph 2 and Page V-49, Section e, paragraph 1

There is an inconsistency in these two paragraphs. Paragraph 2 on page V-47 states, ..."ACC personnel reported inaccurate data being drawn from EIMSURS". Paragraph 1 on page V-49c states, "EIMSURS Data. REMIS seems to provide accurate current data on mission capable rates, possessed hours, and other inventory, utilization, and status indicators"....

49. Page V-49, Section d, paragraph 2

The loss of TCTO data is not a new occurrence. This has been on-going since the conversion of the first F-16 base to CAMS in 1988.

50. Page V-52, Section D2, paragraph 1

Refer to response 42 above. Only certain configuration errors are allowed to exist until the supervisor clears them.

51. Page V-53, Section 2, paragraph 3

Of the 149 Difficulty Reports (DIREPS) generated during the Operational Assessment, about 30 percent (approximately 47) were categorized as software deficiencies, some of which led to data inaccuracies. Another 20 percent (approximately 32) were categorized as data related problems with either missing or incorrect data sourced from CAMS. All DIREPS reported were corrected during/or within two weeks after the Operational Assessment.

52. Page V-54, Section D3, paragraph 4

Security procedures already exist in TICARRS to prevent users from entering data on equipment which they do not own. It does not matter what weapon system is involved or what group in the Air Force has the requirement. Each TICARRS user is assigned an operator ID and password that allows basic access to the system. This is the most basic level of security which prevents unauthorized users from accessing the system at all. Granting of an operator ID and password alone will not allow the user to go beyond the TICARRS Main Menu. Associated with each operator ID are three security elements, a training indicator, a set of security levels, and an authorized organization level. The training indicator allows TICARRS to permit a user to access any function, but prevents any updates from occurring to the database. This is primarily assigned to support training activity or for DRC maintainers to perform tests or investigations on the production system without danger of corrupting data. The security levels are used to permit or restrict access to the various functions within TICARRS. Security levels are defined as a series of "buckets" with a numeric level assigned to each. A "zero" in a bucket indicates no authority for that level, a "nine" in a bucket is the highest authority for that level. TICARRS consists of a number of "conversations" which support one or more functions. For example, CON530 (Maintenance Reporting) provides only one function, entry of On-Equipment Maintenance. CON317 (Part Serial Updates) provides many functions, updating part numbers, updating serial numbers and recording inspection and time change data for serial number - among others. Each function is assigned a specific security level. In the above example, CON530 is assigned a level of 3 in bucket 1. This allows any user with a level of 3 (or higher) in bucket 1 to gain access to CON530 and to report On-Equipment maintenance. Because it provides multiple

functions, CON317 is assigned multiple security levels. A level of 3 (or higher) in bucket 2 might allow the user to update the inspection or time change data. A level of 5 (or higher) in bucket 2 might allow the user to add a new serial number (this would also allow access to updating inspection or time change data). A level of 7 in bucket might allow the user to add a new part number. The authorized organization is used to restrict users to updating data that "belongs" to them. TICARRS maintains an organization structure from fleet level down to work center level. User's can be authorized at various levels within the structure, which allows them to update data for that level and all subordinate organizations. Although a user may have the security level required to access CON530, s/he would not be allowed to report maintenance data for other organizations. Another example of organizational security is the following: Users A and B are assigned the required security level for aircraft status changes. User A is authorized for the 4th FW and User B is authorized for the 334th FS (which belongs to the 4th FW). User A would be allowed to change the status of any aircraft assigned to the wing and User B would only be allowed to update the status of aircraft that belonged to his/her squadron. In general, users who are authorized to access TICARRS are permitted to view any output products within the functions they are authorized for. A user with access to CON560 (Configuration Management) could call up a list of equipment belonging to any organization (they would not be allowed to update the list of that other organization due to organizational security). There are instances where users require access to certain data, but are restricted to certain data values. For example, many repair contractors have been allowed access to the TICARRS database. They often need to call up a maintenance history of an LRU they receive for repair. TICARRS allows for restricting the contractor to viewing history for only LRUs that they are responsible for (thus preventing a competitor from accessing information). They could be restricted to data for specific part numbers or work unit codes. The TICARRS security structure provides the flexibility to support any user profile. Security has been designed into the architecture, which means that as each new function is developed and implemented, security capabilities are built in without additional costs. Since security levels, organizations, and data element restrictions are stored in the TICARRS database, DRC is able to provide maximum flexibility. A user can be granted or denied access to a function (or the system) in a few seconds. All users can be restricted from a specific function in a similar manner (by assigning a new level to the function).

53. Page V-54, Section D4, paragraph 2

TICARRS has a history of successfully handlng expansion throughout its lifetime. TICARRS started with three bases on-line with F-16 A/B models and 4 types of test stations. TICARRS has handled major enhancements and continuous activation of units as the F-16s were deployed worldwide. During that time, TICARRS also handled the expansion to two additional weapon systems on time and within budget.

54. Page VI-4, Section C, bullet 3

TICARRS already has communications established to each of the RPCs.

Table V-1. System Function Comparison

FUNCTIONS COMPARED	CAMS	REMIS	TICARRS
a. Equipment Inventory			
Identification	X	X	X
Location	X	X	X
Assigned/Possessed	X	X	X
Transactions	X	X	X
History - base level	X	X	X
History - Command, theater, fleet		X	X
Equipment Transfer Automated			X
Asset Location			X
b. Equipment Status			
Current - base	X	X	X
Current - Command, theater, fleet		X	X
History - base	X	X	X
History - Command, theater, fleet		X	X
c. Equipment Utilization			
Current - base	X	X	X
Current - Command, theater, fleet		X	X
History - base	X	X	X
History - Command, theater, fleet		X	X
d. Flight Scheduling	X		X
e. Support MOC	X		X
Automated MOC			X
f. Debriefing			
Flight profile, data, discrepancies	X		X
Work order generation	X		X
History - base	X	NO NARRATIVE	X
History - Command, theater, fleet		NO NARRATIVE	X
Repeat/Recur Auto Notification			X
g. Maintenance Scheduling/Reporting			
Work order generation	X		X
Maintenance planning & scheduling	X		X
Job tracking	X		X

FUNCTIONS COMPARED	CAMS	REMIS	TICARRS
TCI Scheduling/Tracking	X		X
Phase Inspection	X		X
Failure histories	BASE	NO NARRATIVE	X
Corrective action histories	BASE	NO NARRATIVE	X
Reliability Measurement		X	X
Maintainability Measurement		X	X
Serialized part maintenance history	BASE		LRUs/SRUs
"Bad Actor" Identification	BASE		LRUs/SRUs
Quality Control/Quality Assurance	BASE	X	X
Fault Isolation Help	X		X
Work Cards for Phase	X		X
CND/RTOK	X	X	X
h. Maintenance-Supply System Interface			
Job site parts ordering	X		
Interface with configuration file	X		
Track status of parts order	X		
MICAP, AWP management	X		
i. Comprehensive Engine Management	X		
j. Cannibalizations Tracking/Management			
Tracking	X		X
Management	X		
k. Configuration Tracking/Management	X	X*	X
l. TCTO Management	X	X*	X
m. Personnel Training/Availability/Scheduling	X		
n. Shop Production Planning/Scheduling/Control	X		X
o. Mobilization Planning			
p. System Deployability			
Deployable Communications Links	X		X
Deployable Information System			X
Other Features			
Test Station Tracking			
Status	X		X
Utilization			X
Maintenance	X		X

FUNCTIONS COMPARED	CAMS	REMIS	TICARRS
Trend Analysis		X	X
Warranty Tracking		X	X
Support Spares Procurement		X	X
Block Number Tracking			X
Integrated Database Management System			X
Journalization Process			X
E-Mail			X
Contractor Network Interface			X
Depot Maint Item Management			X
Real Time Visibility of Fleet Assets			X

*Not fielded in testing

ATTACHMENT 2

CON801 SCN802 CVKAG F530 930721(202)1136
D1$T1

	DOCUMENT #	DONOR EQUIP	CANN JCN	ACTION TAKEN T	ACTION TAKEN U	WUC	EQUIP CANN TO	MAINT JCN	DOC#	WUC	ACTION TAKEN P/Q	ACTION TAKEN T/U	R
01	J301AA31208306	4A0500	1208060	Y	M	82AA0	4A0195	1205404	0000	82AA0	Y	M	M
02	J301AA31198306	4A0500	1198057	Y	M	76BB0	4A0496	1195405	0000	76BD0	M	M	Y
03	J301AA31198300	4E9241	1197225	Y	M	23QB2	4A1703	1192002	0000	23QB2	I	M	M
04	J301AA31188309	4E9034	1187225	M	M	23HAK	4A0195	1182005	0000	23HAK	I	M	M
05	J301AA31178314	4A0500	1188056	M	M	23Z00	4A1676	1092059	0000	23Z00	I	M	M
06	J301AA31188310	4A0500	1188055	Y	Y	82AA0	4A0491	1185407	0000	82AA0	Y	M	M
07	J315BB31178227	4A0500	1178054	M	M	52BA0	4A0485	1172105	0000	52BA0	Y	M	M
08	J315BB31138216	4A0500	1138053	Y	Y	14DA0	4A0230	1132154	0000	14DA0	Y	M	M
09	01990183931051	4A1676	1128047	M	M	11GR1	4A0183	0928005	0000	11GR1	M	I	M
10	01990183931052	4A1676	1128048	M	M	11GR1	4A0183	0928006	0000	11GR1	M	I	M
11	J301AA31108303	4A1676	0128050	M	M	11AF0	4A0183	1092052	0000	11AF0	I	M	M
12	J301AA20930075	4A0500	0128052	Y	Y	55BC0	4A1700	0930225	0000	55BC0	I	M	M

* MORE *

LINE __
OPTION 2 1-FIRST PAGE 2-NEXT PAGE 3-MODIFY 4-DELETE

Shortcut ________ CANN REPORT CO 802

ATTACHMENT 3

D15T1

OPERATIONAL HOURS LIST
ORG: 40334VKAG

LN	EQUIP	RANGE 930501 - 930530 OP HRS	SORT	LNDS	CURRENT MONTH OP HRS	SORT	LNDS	PREVIOUS MONTH OP HRS	SORT	LNDS
1	870196	1.2	2	2	0.0	0	0	0.0	0	0
2	931111	0.0	0	0	0.0	0	0	0.0	0	0
3	881676	0.0	0	0	0.0	0	0	0.0	0	0
4	870199	0.0	0	0	0.0	0	0	0.0	0	0
5	870183	3.7	3	3	0.0	0	0	0.0	0	0
6	881706	0.0	0	0	0.0	0	0	0.0	0	0
7	881705	2.1	1	1	0.0	0	0	0.0	0	0
8	881704	2.7	2	2	0.0	0	0	0.0	0	0
9	881703	7.2	5	5	0.0	0	0	0.0	0	0
10	881702	0.0	0	0	0.0	0	0	0.0	0	0
11	881700	6.3	5	5	0.0	0	0	0.0	0	0
12	890506	2.1	1	1	0.0	0	0	0.0	0	0

* MORE *

OPTION 2 1-FIRST PAGE 2-NEXT PAGE

Shortcut _____ EQUIP STATUS 532

D. MOA FOR THE OPERATIONAL ASSESSMENT

A copy of the memorandum of agreement (MOA) for the Operational Assessment of TICARRS 92 (referred to as "Tab C" in DRC's general comments) is presented on pages V-41 and V-42. DRC provided the MOA as part of its comments.

MEMO OF AGREEMENT
OPERATIONAL ASSESSMENT OF TICARRS-92
11 FEBRUARY 1993

- **Test Schedule:**

	OPR
– Estimate 2/17/93 - Start (Base selection) (Firm by 2/19/93)	ACC
– Week of 3/1/93 - preview (demo)	ACC/DRC/SPO
– 3/12/93 - test plan due - final	TICARRS PMO
– 3/15/93 - train (2 weeks)	DRC/Test Unit
– 3/29/93 - start test	DRC/Test Unit
– Test duration - 6 weeks	

- **Functionality unable to be tested.**
  - **SBSS interface**
  - **CEMS interface**
  - **Personnel/training subsystems**
  - **Automated forms**

- TICARRS -92 functions: See Attachment 1
  - **TICARRS-92 Functional Capabilities are baselined as of 11 February 1993.**

- Definition of objectives.
  - **To determine if TICARRS-92 can support aircraft maintenance operations using the CAMS/REMIS functions as the baseline for comparison.**

- **The integrity of CAMS/REMIS data base for the test base will be maintained for the period of the test. The test will be structured so that data entry for this purpose is transparent to the persons making the TICARRS-92 data entry. Costs associated with this effort will not be used in the test evaluation.**

MEMO OF AGREEMENT
OPERATIONAL ASSESSMENT OF TICARRS-92
(CON'T)
11 FEBRUARY 1993

- **If TICARRS-92 is non-functional in a particular area, (e.g., training, CEMS, SBSS, etc) the costs associated with separate access to and use of these functions will be measured and reported as part of the test.**
- **A preview/demonstration will be conducted at the host unit to develop the procedures associated with both non-functions and workarounds, taking into account the following:**
  - **Continued maintenance of the CAMS/REMIS data bases**
  - **Workarounds to those systems where TICARRS-92 is non-functional**
  - **Preview will be on a TICARRS-92 F-16 database - week of 3/1/93**
  - **Any procedures and workarounds identified will be documented and become part of the test plan.**
- **Test Outline (see Attachment 2) to be developed and conducted in accordance with AFR 700-4**
- **Software to be baselined and frozen prior to beginning of test. Any changes must be agreed to by the test director. Configuration control changes will be strictly enforced in accordance with DRC Standard procedures during test.**

Albert Rand
Dynamics Research Corporation

Clifford Hall 11-Feb-93
Clifford Hall
CAMS/REMIS System Program Director

William S. Tierney
William S. Tierney, Col, USAF
ACC Representative