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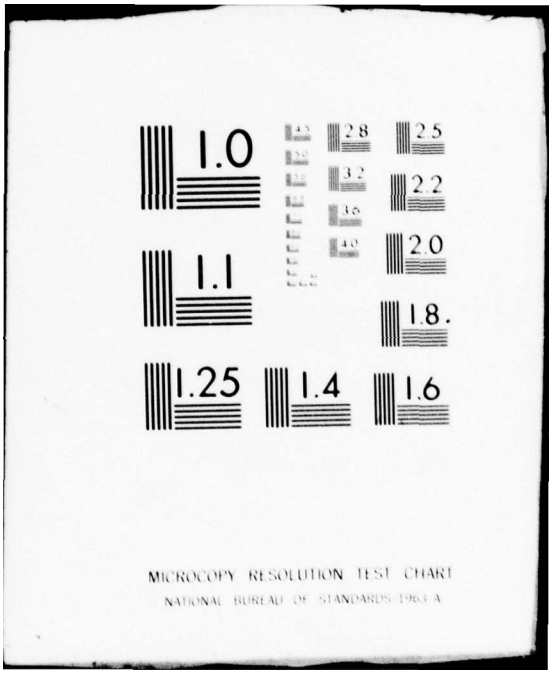
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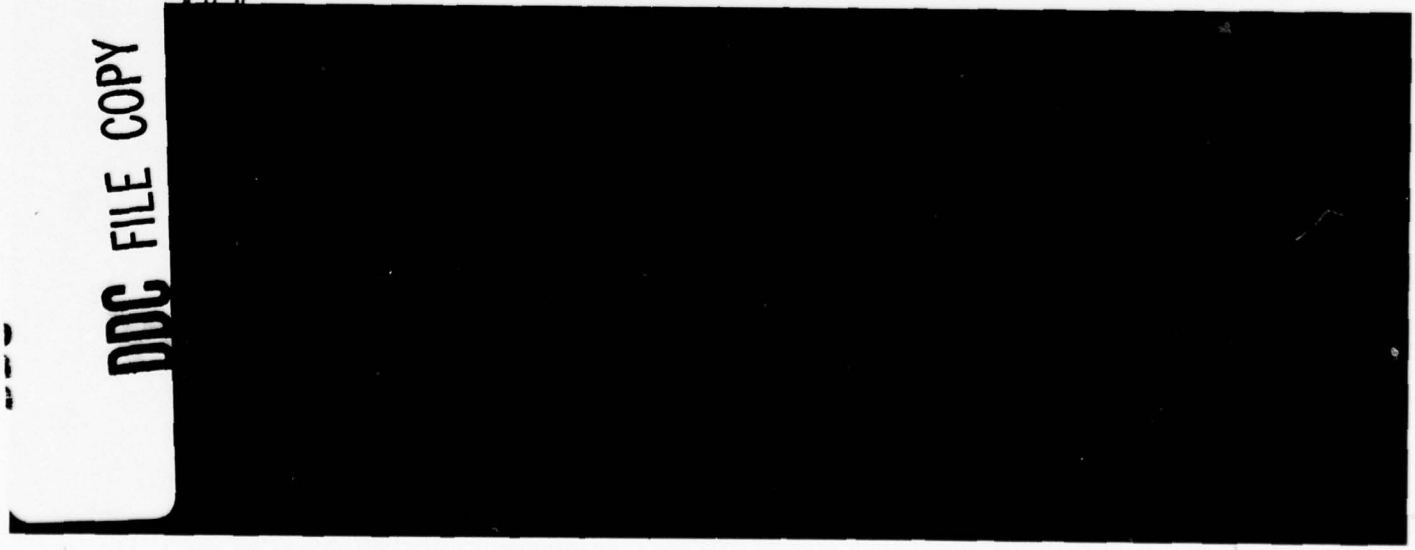
FINAL REPORT

RELIABILITY IMPROVEMENT WARRANTY TERMS AND CONDITIONS FOR THE INTEGRATED AVIONICS CONTROL SYSTEM (IACS)

May 1979

Prepared for
PROJECT MANAGER
INTEGRATED AVIONICS CONTROL SYSTEM (IACS) PROJECT OFFICE
FORT MONMOUTH, NEW JERSEY 07703
under Contract DAAB07-78-A-6606

ARINC RESEARCH CORPORATION



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ARINC Research Corporation assisted the IACS Project Office in the development of draft RIW terms and conditions on which the LSA comparison will be based. This report presents the activites that were preformed and describes the draft RIW terms and conditions that were developed.

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RELIABILITY IMPROVEMENT WARRANTY TERMS AND CONDITIONS FOR THE INTEGRATED AVIONICS CONTROL SYSTEM (IACS)

May 1979

Prepared for

Project Manager
Integrated Avionics Control System (IACS) Project Office
Fort Monmouth, New Jersey 07703

under Contract DAAB07-78-A-6606

by

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FOREWORD

This final report describes the work performed by ARINC Research Corporation from January 1979 through May 1979 for the Integrated Avionics Control System Project Office at Fort Monmouth, New Jersey, under Contract DAAB07-78-A-6606. The project engineer was Mr. Larry Cox; Dr. Richard Kowalski and Mr. Armand Bilodeau contributed significantly to the project.

We acknowledge the assistance provided by Mr. Carl Galanti, Mr. Norm Colten, and Mr. Charles Pleckaitis of the U.S. Army Avionics Research and Development Activity. Personnel at Rockwell International - Collins Government Avionics Division and at Grumman Aerospace Corporation - Avionics Division were also helpful and cooperative.

ABSTRACT

The Integrated Avionics Control System (IACS) is under the management of the Advanced Systems Division of the U.S. Army's Avionics Research and Development Activity, Fort Monmouth, New Jersey.

Engineering Development (ED) contracts were awarded to the Collins Government Avionics Division of Rockwell International and to the Avionics Division of Grumman Aerospace Corporation in October 1976. One of the features of the ED program will be a complete logistics support analysis (LSA) of Reliability Improvement Warranty (RIW) as an alternative to Army organic support.

ARINC Research Corporation assisted the IACS Project Office in the development of draft RIW terms and conditions on which the LSA comparison will be based. This report presents the activities that were performed and describes the draft RIW terms and conditions that were developed.

SUMMARY

The Advanced Systems Division of the U.S. Army Avionics Research and Development Activity at Fort Monmouth, New Jersey, has issued Engineering Development (ED) contracts to two contractors for the Integrated Avionics Control System (IACS). One of the features of the ED program will be a complete logistics support analysis (LSA) of Reliability Improvement Warranty (RIW) as an alternative to Army organic support.

ARINC Research Corporation assisted the IACS Project Office in the development of draft RIW terms and conditions on which the LSA will be based. The RIW terms and conditions were developed by the following process:

1. Three sample sets of RIW terms and conditions applicable to the IACS were developed for review by the IACS Project Office.
2. From these, a baseline set of terms and conditions was developed.
3. Comments and suggestions were solicited from interested Army organizations and incorporated to form a revised baseline.
4. The revised baseline was explained to both contractors and they were encouraged to submit suggestions and alternatives.
5. All comments were reviewed and used to modify, update, or otherwise revise the existing baseline and develop a new one.

As a result of this effort a set of draft RIW terms and conditions was developed that was tailored to the specific design, procurement, and deployment features of the equipment with the intent of providing ample protection for the Army while not imposing undue risk on the contractor. Each contractor had an opportunity to understand his responsibilities under RIW and to contribute his insight and knowledge to the development of the terms and conditions. Furthermore, the terms and conditions developed constitute a unique approach to the consideration of redundancy in a mean-time-between-failures (MTBF) guarantee.

ARINC Research recommends that further iterative negotiations be conducted with both contractors, and that both the MTBF guarantee provisions and the utilization-rate adjustment formulas be subjected to sensitivity analyses before the terms and conditions are implemented in the Initial Production contract.

CONTENTS

CHAPTER ONE

INTRODUCTION

The Integrated Avionics Control System (IACS) program is under the management of the Advanced Systems Division of the U.S. Army Avionics Research and Development Activity, Fort Monmouth, New Jersey.

Engineering Development (ED) contracts were awarded to the Collins Government Avionics Division of Rockwell International and to the Avionics Division of Grumman Aerospace Corporation in October 1976. One of the features of the ED program will be a complete logistics support analysis (LSA) of Reliability Improvement Warranty (RIW) as an alternative to Army organic support.

Under Contract DAAB07-78-A-6606, ARINC Research Corporation assisted the IACS Project Office in the development of draft RIW terms and conditions on which the LSA will be based. This report presents the activities that were performed and describes the draft RIW that was developed.

1.1 BACKGROUND

The U.S. Army Avionics Research and Development Activity initiated a program in 1972 to develop an integrated cockpit control and display system for use in Army helicopters. The guidelines established at that time were for a system that would: (1) provide control of the avionics equipment through a single integrated panel, (2) reduce aircrew workload, and (3) increase avionics configuration flexibility.

In 1974 an experimental model was designed, built, and evaluated by the Army. This resulted in the development in 1976 of an integrated avionics system specification that served as the nucleus of the present engineering development program. Other guidelines incorporated in the program were to control production cost, minimize maintenance, reduce weight, and have high reliability. The program employs the design-to-cost (DTC) concept to ensure that the system can be produced and supported economically by the Army. The design to unit production cost (DTUPC) goal for this program is $23,000 in FY'76 dollars, assuming that 500 systems are produced at a rate of 15 to 25 per month.

Engineering development (ED) contracts were awarded to Collins Avionics, Cedar Rapids, and to Grumman Aerospace, New York. Under each contract eight fully qualified systems are to be delivered for formal flight and operational tests. The qualification test program is being conducted jointly by the contractors and the Army's Test and Evaluation Command. The program will result in a complete production procurement package. One of the competing ED contractors will be selected for the initial production contract. Production systems should be available in 1982.

1.2 SYSTEM DESCRIPTION

The basic IACS, nomenclatured by the Army as the AN/ASQ-166, consists of five line replaceable units (LRUs): (1) primary control unit, (2) secondary control unit, (3) status panel, (4) primary interface unit, and (5) secondary interface unit.

The primary control unit displays mode and frequency information and other data on its front panel, provides mode controls, provides display controls, and provides for keyboard entry of data. This unit will control up to 10 avionics equipments that can be remotely located in the aircraft. It will control such functions as selection of preset frequencies and tuning to new frequencies. Dedicated switches were included for functions such as recovery of last frequency, guard, and erasure of sensitive information.

The secondary control unit provides a minimum control capability for emergency situations. The specification requires it to control one FM radio, one AM radio, and an automatic direction finder as a minimum. It is expected that this unit will be used in cockpits for which space or funding does not permit a primary unit for each operator.

The status panel is a small, lightweight, one-line display that provides frequency and mode information on the transmitting radio. It is expected that the status panel will be installed near the top of the instrument panel.

The two interface units provide a means of interfacing the other three IACS units with the controlled subsystems. For the initial deployment of the system, all subsystems will be controlled through these interface units. Later, new subsystems will be designed to interface directly onto the data bus. The IACS is capable of operating as a subsystem of a larger bus system or in a dynamic bus allocation mode.

1.3 ARINC RESEARCH ACTIVITY

One of the features of the ED program will be a complete LSA of RIW as an alternative to Army organic support. ARINC Research assisted the IACS Project Office in developing baseline RIW terms and conditions,

coordinating the terms and conditions with the U.S. Army, coordinating the terms and conditions with the contractors, and documenting the study efforts and the RIW terms and conditions developed for use in the LSA comparison. The terms and conditions developed also provide a starting point for negotiations of the RIW for the initial production (IP) phase should RIW be the approach selected.

Chapter Two of this report summarizes engineering activities completed during the contract period of performance and Chapter Three contains the conclusions and recommendations. The appendix is a draft of warranty terms and conditions developed for the IACS.

CHAPTER TWO

ENGINEERING ACTIVITY

2.1 RIW DEVELOPMENT

The goal of RIW in the IACS program is to give the successful production contractor the incentive to design and produce a system that will meet specific reliability requirements when used in the field. The contractor should be provided the opportunity and flexibility to improve the IACS following production and deployment. Simultaneously, the RIW should protect the Government by providing a systematic approach for controlling ownership costs.

ARINC Research was tasked to develop RIW terms and conditions to be used in the LSA of the ED contract and to form a starting point for negotiations of the RIW for the IP solicitation, should RIW be the selected approach. The RIW terms and conditions were developed by the following process:

1. ARINC Research Corporation developed three sample sets of RIW terms and conditions and provided them to the IACS Project Office. These samples presented differing RIW philosophies which could logically be applied to IACS. These included examples of several options that have been used in previous similar warranties. This enabled the personnel in the IACS Project Office to familiarize themselves with varying forms of RIW and to understand the relationship between those forms and particular objectives for the IACS.

2. Discussion sessions were held with members of the IACS Project Office to fully explain the options available and to identify those provisions most consistent with the RIW goals, equipment deployment, and support requirements of the IACS. The product of these discussions was one baseline set of RIW terms and conditions incorporating the specific goals and objectives of the IACS Project Office.

3. The IACS Project Office provided the baseline set of RIW terms and conditions to interested and affected Army organizations for comments and suggestions. After all comments and suggestions were received, they were thoroughly examined in later discussions between ARINC Research and the IACS Project Office. As a result of these discussions, the existing baseline was modified and revised and a new one developed.

4. The revised baseline terms and conditions were distributed by the IACS Project Office to both contractors. In meetings held at the contractors' facilities attended by personnel from ARINC Research and the IACS Project Office, the terms and conditions were fully discussed and explained. The contractors were encouraged to present their suggestions, opinions, or alternative methods for achieving RIW goals in a cost-effective manner.

5. Comments from the contractor meetings were collected and reviewed jointly by the IACS Project Office and ARINC Research. On the basis of the comments and suggestions from the joint review, ARINC Research developed the revised set of RIW terms and conditions for the IACS. These are presented in an appendix to this report.

This approach to the development of the RIW provided for a free exchange of ideas between Army and contractor personnel. Each participant was allowed to present his suggestions on how the terms and conditions could be improved, how changes might permit the contractor to reduce his cost of assuming RIW responsibilities, and how changes might improve the protection provided the Government without drastically increasing contractor risk. Many suggestions from the contractors and Army personnel were incorporated in, or modified for incorporation in, the RIW terms and conditions that appear in the Appendix.

2.2 SUMMARY OF RIW FEATURES

The RIW terms and conditions developed are best reviewed by highlighting the major provisions. As appropriate, comments are provided on features that require further consideration before incorporation into a final contract. Implementation of the Warranty is on an LRU basis.

2.2.1 Statement of Warranty

The two basic clauses of the RIW are as follows:

- "The Contractor warrants that each ... IACS furnished under this contract will be free from defects in design, material, and workmanship and will operate in its intended environment in accordance with contractual specifications ... for the warranty period set forth herein."

- "Any IACS LRU furnished under this contract that fails to meet the aforesaid warranty and is returned to the Contractor by the Government shall be either repaired or replaced, at the Contractor's sole option and expense, so as to operate in accordance with said specifications."

2.2.2 Warranty Period

Each IACS LRU is covered under the warranty, starting with Government acceptance and extending to 60 months after the Initial Accounting Date (IAD). The IAD is defined as the date of the successful completion of

DT III PVT-G (Production Validation Testing - Government), which must be completed before the equipment can be formally released for installation. The purpose of this arrangement is to have the production units under warranty for an average of 48 months and to have the warranty expire on the same date for all units to simplify planning for the transition to total organic maintenance. Figure 1 is a time line for a typical production contract of this type illustrating the relationship of events.

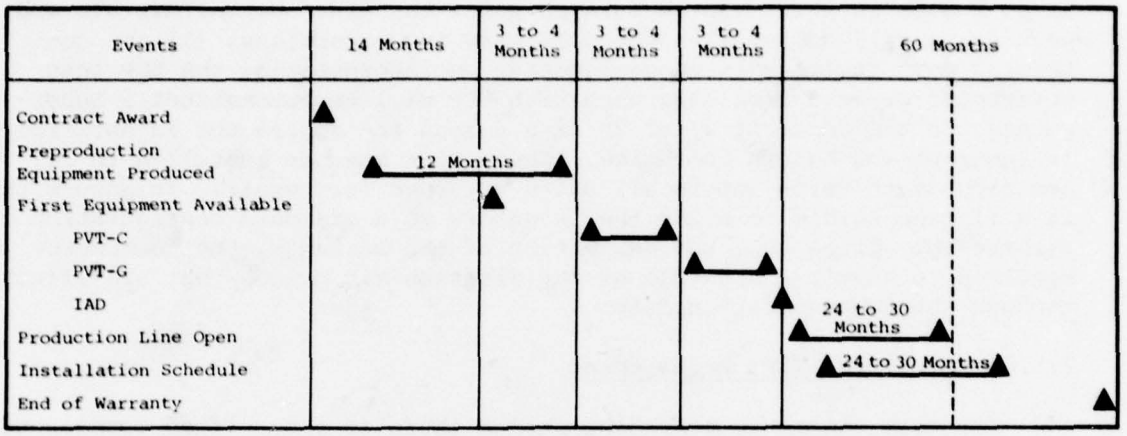

Figure 1. TIME LINE FOR TYPICAL PRODUCTION CONTRACT

2.2.3 Exclusions

Units whose failure is due to fire, explosion, submersion, acts of God, aircraft crash, enemy action, or mistreatment are considered exclusions from warranty, and the contractor is not obligated to repair or replace these units at no cost to the Government. The contractor must present clear and convincing evidence to substantiate a claim for an exclusion. For exclusions whose estimated cost to repair is less than an agreed-on threshhold, the contractor is authorized to perform the necessary repair and bill the Government for the cost. This provision is designed to expedite the repair of exclusions when the associated cost is low. A separate agreement is to be negotiated for repair of excluded returns whose cost is above the agreed-on threshhold.

2.2.4 Unverified Failures

The contractor will be reimbursed an agreed-on amount, representing an estimate of contractor costs for processing, for each good unit returned in excess of the maximum of (1) 12 returns or (2) 20 percent of all verified returns over a six-month period. The 20-percent figure represents an estimate of the IACS false-return rate assuming the Government has

field bench testing for failure verification in addition to the IACS built-in test equipment. The contractor can use this rate as a bound for pricing. However, if a contractor believes that the combination of his design, training, and manuals will lead to a lower percentage, he may choose to lower his price accordingly.

2.2.5 ECPs and Configuration Control

Contractor-initiated ECPs to improve reliability and maintainability at no change in price are encouraged under the RIW. Normal MIL-STD-480 procedures will apply, with the following two exceptions: (1) the contractor must include his recommendation on incorporating the ECP into Government-owned spares; (2) each such ECP will be automatically incorporated in the contract after 35 days unless the contractor is notified of its nonapproval before that time. These ECPs must be installed in all new production units and in all units returned for repair. To ensure that it will be possible to bring the inventory to a standard configuration at a reasonable price upon the expiration of the warranty, the contractor is required to submit a schedule of modification-kit prices that are effective through the RIW expiration date.

2.2.6 Turnaround Time Requirement

For each six-month reporting period there is a specified turnaround time. This is the time between the arrival of the LRU at the contractor's facility and the time at which it is subsequently repaired and moved to a secure storage area. Initially, the contractor has an average of 30 calendar days to complete these tasks. In subsequent six-month periods, this time is reduced until, after 24 months, he has an average of 15 calendar days to perform these actions. This reduction in turnaround time not only takes into account the learning process the contractor will undergo in repairing failures but also balances his learning process against the expected number of installs and spares in the field. If the turnaround time for a particular period is not met, the contractor is assessed a liquidated damage equal to an agreed-on amount multiplied by the number of units processed in the period multiplied by the number of days by which the turnaround time exceeds the specified average. Liquidated damages will not be collected in any measurement period if during that period the Government had sufficient assets in the secure storage area to meet each asset demand within a specified time limit. The Contractor is also eligible to receive an upward price adjustment for achieving an extraordinarily short turnaround time, thus providing an incentive to reduce his turnaround time to below the specified value.

2.2.7 Utilization Rate Adjustment

The contractor is required to bid the warranty price on the basis of a projected schedule for production and installation and an operating time of 20 hours per month for each installed IACS LRU. A method has been developed for estimating actual operating time from elapsed-time-indicator (ETI) readings, installation and removal dates on returned units, and reported number of installations. A contract price-adjustment formula is

provided; it will be used for deviations greater than 10 percent from the projected "pricing standard". The methodology presented is somewhat innovative in that it takes into consideration the varying IACS configurations expected to be installed. As such, it should be subjected to sensitivity analysis before being implemented in the initial production contract.

2.2.8 Government Obligations

To the extent possible, the Government is required to verify failures before they are returned to the contractor, furnish failure-circumstance data, use appropriate packaging, mail via air parcel post with return receipt, and notify the contractor by electronic message that these have all been accomplished. In the event that any or all of these conditions are not met, the warranty will remain in effect for such returns but the Government may not receive a replacement LRU until required information is provided. In addition, the Government agrees to provide the contractor with information regarding the number of IACS installations at the end of each six-month measurement period.

2.2.9 Miscellaneous

The RIW also contains provisions for labeling and seals, price adjustments for lost units, serial number record keeping, and technical manual requirements.

2.2.10 MTBF Guarantee

The MTBF guarantee includes the effect of redundancy built into the IACS. Thus the achieved system MTBF must be calculated analytically on the basis of verified failures returned to the Contractor, estimated operating hours, and the specific system design. To incorporate the different design philosophies of the two competing contractors, each is independently required to provide to the Government the method for calculating achieved system MTBF on the basis of the measured failure rates of the LRUs and the contractor's particular system design. Following Government approval of the contractor-provided methodology, it will become an attachment to the terms and conditions. Thus the MTBF value agreed on will be the same for both contractors, but the methodology for calculating the achieved value will differ.

The basic requirement of the MTBF guarantee is that "... the achieved MTBF of the IACS, as calculated in the approved Contractor-provided attachment, is equal to or greater than ..." specified values that increase over the warranty period.

In the event the achieved MTBF is less than the guaranteed MTBF, the contractor shall furnish the following at no cost to the Government:

- Engineering analysis to determine the reasons for not achieving the guaranteed figure, including the causal relationship by LRU type

- Corrective engineering design changes
- Modification of units as required
- Consignment spares as needed by the Government and determined by the Contracting Officer

Equations are provided to define the maximum number of consignment spares the contractor may be required to provide: "The Contracting Officer ... will determine the actual number of consignment spares of each LRU type to be provided ..., but in no event shall the actual number exceed that provided by the formula .... If, in the opinion of the Contracting Officer ... one (or more) LRU types had no impact on the nonconforming system MTBF and there were sufficient assets of that LRU type in the secure storage area during the measurement period specified ..., then consignment spares for that LRU type shall not be required." Provisions exist for the contractor to pay liquidated damages in the event consignment spares are required and he is not able to meet the requirement. Further provisions allow for the return of consignment spares and for the return of up to 50 percent of the liquidated damages paid once the MTBF has improved. The contractor may qualify for an upward price adjustment at the completion of the RIW period if the achieved MTBF of the IACS is extraordinarily high.

The MTBF guarantee is based on the achieved MTBF of the system as calculated from the measured failure rates of the LRUs; yet when a guaranteed MTBF value is not met, the penalty is in terms of consignment spares of individual LRUs. As such, it constitutes a unique approach to the consideration of redundancy in an MTBF guarantee. Although designed to consider these interacting relationships adequately, the guarantee should be subjected to an in-depth sensitivity analysis before it is implemented in the initial production contract.

2.2.11 Data Requirements

Four data items are required to administer and support the RIW:

- A plan defining the exact form, content, and placement of the warranty notice and installation and removal labels plus a detailed plan for the design and placement of seals
- A Data Collection and Analysis Plan describing how the Contractor will accumulate, process, analyze, and report the information required under RIW
- A semiannual Warranty Data Report containing, as a minimum, the following records:
  - Delivery and shipment dates
  - Corrective action summaries
  - Secure-storage-area statistics
  - LRU corrective-cycle times

- Reliability summary
- Modification status summary
- Warranty population statistics
- Contract price adjustment and MTBF guarantee statistics

• An annual Warranty Effectiveness Report containing the contractor's experiences and conclusions regarding the effectiveness of the warranty concept as applied to this contract

2.2.12 Negotiation of Alternate Means for Equitable Adjustment of Funds

In all instances involving the transfer of funds (such as adjustments in contract price or the assessment of liquidated damages), the Contracting Officer has the right to negotiate with the contractor alternate means for the equitable adjustment of such funds as may be mutually agreeable to both parties. This allows for goods or services to be provided in lieu of money should both parties be agreeable.

CHAPTER THREE

CONCLUSIONS AND RECOMMENDATIONS

3.1 CONCLUSIONS

The process used to develop the Reliability Improvement Warranty (RIW) for the Integrated Avionics Control System (IACS) ensured that each Contractor had an opportunity not only to understand his responsibilities under RIW but also to contribute his insight and knowledge to the development of the terms and conditions.

The IACS RIW was tailored to accommodate the specific design, procurement, and deployment features of the equipment. The intent is to provide ample protection for the Army while not imposing undue risk on the contractor.

The terms and conditions developed constitute a unique approach to the consideration of redundancy in an MTBF guarantee.

3.2 RECOMMENDATIONS

While the draft terms and conditions developed in this effort are adequate for the LSA required under the Engineering Development (ED) contract, further refinements are needed before they are implemented in the Initial Production (IP) contract. Accordingly, we recommend that the IACS project office perform the following tasks before the IP award:

- Further iterative negotiations with both contractors to ensure that each has a thorough understanding of the responsibilities and risks associated with RIW and is prepared to price and manage the RIW responsibilities associated with the contract
- In-depth sensitivity analyses of the MTBF guarantee provisions (including the calculation of consignment spares) to assure consistency and adequacy of the provisions
- A sensitivity analysis of the utilization-rate adjustment formulas to ensure that the amount calculated is reasonable

APPENDIX

DRAFT WARRANTY TERMS AND CONDITIONS FOR THE INTEGRATED AVIONICS CONTROL SYSTEM (IACS)

This appendix contains the draft warranty terms and conditions developed for the Engineering Development logistics support analysis of the Integrated Avionics Control System.

Values still requiring negotiation are enclosed in a rectangle [ ].

Note that the contractor-provided attachments describing the methodology for calculating achieved MTBF are not included at this time.

Part I - Statement of Warranty

1. The Contractor warrants that each Integrated Avionics Control System (IACS) furnished under this contract will be free from defects in design, material, and workmanship and will operate in its intended environment in accordance with contractual specifications, as amended by the approved failure verification and repair test procedure (FV/RTP) set forth in (contractor) Drawing Number _____ titled _____ _____ dated _____, for the warranty period set forth herein. Each IACS shall consist of varied configurations of the following units:

- Interface Unit, Primary J-3588/ASQ-166
- Interface Unit, Secondary J-3585/ASQ-166
- Control Indicator, Primary C-10515/ASQ-166
- Control Indicator, Secondary C-10514/ASQ-166
- Indicator, Status - ID-2171/ASQ-166

Each of these hereinafter shall be referred to as an IACS line replaceable unit (LRU).

2. Any IACS LRU furnished under this contract that fails to meet the aforesaid warranty and is returned to the Contractor by the Government shall be either repaired or replaced, at the Contractor's sole option and expense, so as to operate in accordance with said specifications. Following contractor corrective action, satisfactory operation of an LRU shall be demonstrated by successful completion of the approved FV/RTP for the individual LRU. The Contractor shall have the prerogative of performing additional tests if he desires. The Contractor is not required to perform cosmetic repairs to correct items such as scratches, paint chips, minor dents, etc., on the exterior surface of LRUs returned under this warranty that affect only the appearance and not the performance of the LRU. The Government shall have the right to witness the repair test procedure and review the documented results.

3. The Contractor shall not be obligated to correct or replace at no cost to the Government any IACS LRU under these warranty provisions for nonconformance, loss, or damage by reason of (1) Non-IACS Induced Fire; (2) Non-IACS Induced Explosion; (3) Submersion; (4) Acts of God, such as flood, hurricane, tornado, earthquake, lightning, etc.; (5) Aircraft Crash; (6) Enemy Action; (7) Accidental or willful mistreatment or tampering by noncontractor personnel. The conditions specified, except acts of God, apply only to loss and damages occurring on locations other than those owned and controlled by the Contractor or occurring while the IACS LRU is not under the Contractor's possession or custody. There is a presumption that an IACS LRU returned to the Contractor's repair facility during the warranty period is covered under this warranty and that only the exclusions listed shall void the Contractor's responsibility to correct or replace at

no increase in contract price under this warranty. Clear and convincing evidence must accompany the Contractor's claim for relief from warranty obligation for any of the listed exclusions.

While broken seals (as specified in Part III, paragraph 3) per se are not cause for exclusion from the warranty provision, the Contracting Officer will consider this, together with all other evidence which may be submitted by the Contractor in support of a claimed exclusion from the warranty provisions.

4. Notwithstanding the provisions of the "Inspection" (1958 May) Clause [DAR 7-108.5(a)] regarding the conclusiveness of acceptance and the waiver of defects that are susceptible to discovery prior to acceptance, the Contractor shall be obligated to correct or replace any nonconforming IACS LRU in accordance with the terms and conditions of this warranty. The rights and obligations of the parties under this warranty are in addition to and independent of the rights and obligations of the parties under the other provisions of this contract. Except as provided by the general provision of this contract entitled "Inspection", the Contractor's obligations and the Government's remedies for correction and replacement of nonconforming IACS LRUs are solely and exclusively as stated herein. In no event shall the Contractor be liable for special or consequential damages.

5. For all LRUs purchased under this contract, the warranty period shall start upon Government acceptance of the LRU (signing of the DD 250) and shall extend until 60 months after the *IAD defined in Part I, paragraph* 6.

6. For the purposes of this warranty, the Initial Accounting Date (IAD) shall be defined to be the date of successful completion of DT/OT III PVT-G (Production Validation Testing - Government) testing. The Contractor will be notified of the IAD date by the Administrative Contracting Officer (ACO) prior to the release of the PVT-G Test Report. In any event, such notification will occur no later than 90 days after the successful conclusion of PVT-G testing. This IAD will be used to establish reporting and adjustment periods for this warranty.

7. In all instances involving the transfer of funds specified in other parts of this contract (such as adjustments in contract price, the assessment of liquidated damages, etc.) the Contracting Officer shall have the right to negotiate with the Contractor alternate means for equitable adjustment of such funds as may be mutually agreeable to both parties.

Part II - Government Obligations

1. The Government shall, to the extent possible, adhere to the following procedures:

a. Verify failures using Government/Contractor approved procedures and test equipment.

b. Furnish to the Contractor complete failure circumstances data and test readings.

c. Note on the maintenance request any known inadvertent breakage of seals.

d. Use appropriate packing and packaging when returning LRUs under warranty and ensure that all shipping containers are properly addressed and appropriately marked.

e. Promptly ship each failed LRU to the Contractor via air parcel post with return receipt.

f. Notify the Contractor by electronic message that the LRU has failed and provide the serial number of the failed LRU, the receipt number of the package in which the failed LRU was shipped, and shipping instructions for delivery of a replacement LRU.

However, in the event that any or all of the above conditions are not met for an LRU, the warranty shall remain in effect for such LRU.

2. Should the electronic notification of failure received at the Contractor's repair facility not include a valid receipt number for the package in which the failed LRU was shipped, or not include shipping instructions for delivery of a replacement LRU, the ACO shall initiate action to obtain the required information as soon as possible.

3. The Government agrees to provide to the Contractor information regarding the number of IACS installations over six-month measurement periods. The first such period shall end six months after the IAD defined in Part I, paragraph 6, and subsequent six-month periods shall follow consecutively until warranty termination. The first installation report shall include information regarding all IACS installations prior to the end of the first six-month measurement period. Subsequent reports shall contain information on IACS installations during the corresponding measurement period. Each report shall be furnished to the Contractor not later than thirty (30) days after the end of the six-month measurement period. The installation report will include both a description and the number of IACS configurations installed.

4. The Government agrees that all no-change-in-contract-price ECPs to improve reliability or maintainability of the LRUs that are complete, are submitted in accordance with MIL-STD-480, and contain the Contractor's recommendation concerning incorporation of the ECP into Government-owned spare LRUs in the secure storage area (Part III, paragraph 8) will receive expeditious processing through the approval cycle. Notwithstanding this special processing, any such ECP shall be automatically incorporated in the contract by the Government thirty-five (35) calendar days after receipt of such ECP by the Contracting Officer unless the Contractor has received written notification of its nonapproval prior to that date. Disapproval of any no-cost RIW ECP shall not relieve the Contractor of his obligations pursuant to this contract. ECPs developed and submitted for other purposes will be subject to the normal ECP review cycle.

5. Analyses that identify contract price adjustments, a need for engineering analysis or corrective engineering actions, or a requirement for the furnishing or returning of consignment spares in accordance with the provisions of other parts of this contract shall be reviewed by the Contracting Officer and approved by him prior to implementation of these actions. The Contracting Officer's decision shall be final.

Part III - Contractor Obligations

1. The Contractor shall cause a suitable and prominent display of warranty information in form and content satisfactory to the Contracting Officer to be placed conspicuously on the surface(s) of each LRU in a way that ensures visibility when the LRUs are removed from the aircraft. Figure 1 is an example of a typical warranty notice and indicates the information desired on the notice. The specific format and contents may be selected by the Contractor with the approval of the Contracting Officer.

WARRANTY NOTICE

This unit is under Warranty until (date to be inserted)

DO NOT BREAK OR TAMPER WITH WARRANTY SEALS

IF THIS UNIT FAILS WITHIN THE WARRANTY PERIOD, THE FOLLOWING ACTIONS MUST BE TAKEN:

(1) Verify the failure using approved procedures and test equipment of TM (to be inserted).

(2) Record failure circumstance data and line tester findings on (appropriate form reference to be inserted).

(3) Package in accordance with Section II of TM (to be inserted) and promptly return with failure circumstance data and line tester data to (insert contractors address) via air parcel post with return receipt.

(4) Notify the contractor via electronic message of the returned item including information required in TM (to be inserted), in particular the receipt number and return address.

Figure 1. TYPICAL WARRANTY NOTICE

2. The Contractor shall place a suitable label for permanently recording LRU installation and removal data, in form and content suitable to the Contracting Officer, conspicuously on the surface of each LRU under warranty. The specific format and placement of the label may be selected by the Contractor with the approval of the Contracting Officer. The format

selected must allow for multiple installations and removals (the exact number to be approved by the Contracting Officer) and for each installation and removal action must accommodate the following:

a. Entry of aircraft type, Julian date installed, and organizational unit code to be entered in the field upon installation.

b. Entry of Julian date removed to be made in the field upon removal.

c. Entry of a code representing the result of Contractor/ACO action to be made upon joint inspection of the LRU at the Contractor's repair facility. The coding scheme is as follows:

0 - LRU removed for other than warranty repair

1 - Failure not covered under warranty (ACO concurrence)

2 - Failure verified, corrective action taken under warranty

3 - Failure not verified (ACO concurrence)

3. The Contractor shall provide and install appropriate seals for all LRUs which shall minimize inadvertent seal breaking. Furthermore, the design of the seals should be such that a breaking of a seal through tampering is detectable.

4. The Contractor shall submit for Government approval the proposed content, wording, placement, material, and method of application of items required in Part III, paragraphs 1, 2, and 3.

5. The Contractor shall insert a notice in all technical manuals that cover the LRUs to the effect that they are under warranty. The Contractor shall place those warranty provisions applicable to using activities conspicuously in all pertinent Technical Manuals developed under this contract.

6. The Contractor shall maintain throughout the warranty period a fully operational warranty-repair facility located in the continental United States. The Contractor shall maintain at this repair facility a secure area for storage of Government-owned IACS LRUs. (It should be noted that the number of Government-owned LRUs to be maintained in the secure area may vary according to the needs of the Government).

7. Upon either (a) receipt of notification of failure, including a valid receipt number of the package in which the failed LRU was shipped and shipping instructions for delivery of a replacement LRU, or (b) receipt of a failed LRU for which prior notification was not received, the Contractor shall ship a replacement Government-owned LRU from the secure storage area to the appropriate Government facility via air parcel post. To the extent possible, LRUs will be selected for shipping from the secure storage area on a first-in/first-out (FIFO) basis. Such shipment shall be made within one working day from the time of receipt of notification, but in no event shall such shipment be made later than 72 hours after receipt of notification. For shipment, the Contractor shall use air parcel post (with reimbursement) accompanied by a DD Form 1149 for transfer of

Government property accountability. In the event there are insufficient LRUs in the secure storage area to meet demands, the Contractor shall follow a shipping and priority system as directed by the ACO.

8. Contractor-initiated ECPs to improve LRU reliability or maintainability are encouraged under this warranty. All no-change-in-contract-price ECPs shall be submitted in accordance with MIL-STD-480 and shall include a recommendation by the Contractor whether or not the ECP should be incorporated into the Government-owned LRUs in the secure storage area. If the recommendation is to incorporate the ECP into such LRUs, the Contractor shall also include a proposed schedule for accomplishing such modifications. All Government approved no-change-in-contract-price ECPs shall be incorporated into all new production LRUs, into applicable prior production LRUs returned by the Government to the Contractor for repair, and into applicable Government-owned LRUs in the secure storage area if so decided by the Contracting Officer according to the approved schedule.

As part of each no-change-in-price ECP, the Contractor agrees to submit a schedule of prices on a per-kit basis to the Government for supplying the necessary parts (modification kits, instructions, or other necessary material and supplies) for LRUs in the Government inventory that will not have the ECP incorporated by the end of the warranty period. The Government option to buy these necessary parts (modification kits, etc.) at the ECP price schedule shall extend until the warranty expiration date for the IACS.

This provision does not limit the Contractor's rights or privileges to develop and submit cost ECPs for other purposes or for the purpose of improving reliability or maintainability if all contract commitments are being exceeded. RIW-generated ECPs are not subject to the provisions of the value-engineering incentive clause.

9. LRUs returned to the Contractor for repair or replacement under this warranty for which the Contractor cannot verify any failure shall: have installed any outstanding ECP(s) if such ECPs were incorporated into the Government-owned spares in the secure storage area, be subjected to and pass this contract's approved FV/RTP, be packaged, and be delivered to the secure storage area by the Contractor. This shall be done at no change in contract price unless the number of such returns exceeds the greater of (1) an average of two such returns per month or (2) 20 percent of the total number of all returned LRUs in the reporting period that are verified failures (coded "2" in accordance with Part III, paragraph 2c). For purposes of this adjustment, the reporting periods are defined to be six-month periods beginning with the IAD. The Contractor shall present evidence to the ACO or his designated representative that failure of a returned LRU cannot be verified. The ACO shall review and corroborate this determination. The Contracting Officer will adjust the contract price and make payment to the Contractor at the rate of [$200] per LRU for the number of such returns that exceed the foregoing amount in each reporting period.

For those returned LRUs for which failure cannot be verified, the Contractor may, at his own discretion and at no cost to the Government, perform additional testing and change marginal components prior to their delivery to the secure storage area.

For any returned LRU for which failure cannot be verified and where the LRU was also determined to be an unverified failure the last time it was received at the Contractor's repair facility (i.e., a 3 in the code column of the installation and removal label), the Contractor shall perform additional, more extensive testing on that LRU to include testing under extreme environmental conditions. If, in the opinion of the ACO, sufficient testing has been performed to detect unusual or intermittent failures and no failure has been found, then the warranty status shall remain as an unverified failure. However, should any failure be detected as a result of this testing, the warranty status shall be a verified failure (Code 2 per Part III, paragraph 2c).

10. For the LRUs returned to the Contractor that have sustained damage attributable by the Government to the causes and events set forth in Part I, paragraph 3, the Contractor shall present to the ACO a written estimate of the total cost to repair such LRUs, including all processing, testing, and packaging. After ACO review of this estimate, if it is his determination that the estimate is fair and reasonable, and the estimate does not exceed [$200] , the Contractor shall proceed with the repair of such LRUs. At the end of each reporting period the Contracting Officer will adjust the contract price and make payment to the Contractor for the actual cost of all such repairs as long as the actual cost of each repair does not exceed the estimated cost by more than ten percent (10%). If the actual cost of any such repair does exceed the estimated cost by more than ten percent, the Contractor agrees to accept the estimated cost plus 10 percent as payment in full for such repairs. The Contractor agrees to enter into a separate agreement with the Government to cover the correction, repair, replacement, or disposition of LRUs determined by the Government to be exclusions from warranty in accordance with Part I, paragraph 3, and whose estimated cost to repair, including all processing, testing, and packaging, exceeds the value specified above.

Each such LRU returned for repair which upon examination at the Contractor's facility is not considered by the Government to be economically repairable shall be disposed of by the Contractor as directed by the Contracting Officer. The Contractor shall have the right to assess charges for any reasonable services performed as directed by the Contracting Officer in connection with the disposition of any such nonrepairable LRU. Any material required to be furnished by the Contractor in connection with shipment of such LRUs shall be subject to equitable adjustment. The Contractor may retain any such LRUs with the approval of the Contracting Officer if reimbursement is made to the Government for its reasonable value.

Any LRU returned to the Government after replacement hereunder shall have applied hereto the balance of the warranty period of the LRU it replaces.

11. The Contractor shall repair or replace, install approved ECP modifications, perform and pass the Contract's approved FV/RTP, package, and store a returned LRU in the secure storage area in an average time less than or equal to T_{spec} (specified average turnaround time in calendar days). Each LRU's turnaround time starts on the day it is received and logged in at the Contractor's repair facility and ends on the day it is placed in the secure storage area or shipped to a government location, whichever occurs first. This turnaround time requirement shall apply to all units returned except those to which one or more of the exclusions listed in Part I, Paragraph 3 apply and whose estimated cost to repair exceeds the value specified in Part III, Paragraph 10. The Contractor shall not be liable for any time delays if the failure to perform the contract arises out of causes beyond the control and without the fault or negligence of the Contractor. Such causes may include, but are not restricted to, acts of God or of the public enemy, acts of the Government in either its sovereign or contractual capacity, fires, floods, epidemics, quarantine restrictions, strikes, freight embargoes, and unusually severe weather; but in every case the failure to perform must be beyond the control and without the fault or negligence of the Contractor.

The following table defines T_{spec} for each measurement period:

Interval	Specified Average Turnaround Time (T_{spec}) (Calendar Days)
IAD to (IAD + 12 months)	30
(IAD + 12 months) to (IAD + 18 months)	25
(IAD + 18 months) to (IAD + 24 months)	20
6-month intervals after (IAD + 24 months)	15

Calculations of the contractor's average turnaround time shall be made over six-month periods. The first such period shall start with the initial accounting date, and subsequent six-month periods shall follow consecutively until warranty termination. If the average turnaround time in a six-month period exceeds the specified value (T_{spec}), as computed from warranty data records, the contractor will be assessed a liquidated damage in accordance with the following formula:

$$\text{Liquidated Damage} = \boxed{\$25} \times (\bar{T} - T_{spec}) \times Q$$

Q = number of returned LRUs for which the turnaround-time requirement applies (as specified in Part III, paragraph 11) that have been received by the Contractor during the six-month period

$\bar{T}$ = average turnaround time of the Q items returned during the six-month period calculated to one decimal place from the equation $\bar{T} = D/Q$. D is defined as the total number of days for Contractor processing of the Q LRUs returned for warranty service, measured to the nearest half-day for each returned LRU, from the time the

LRU is received by the Contractor to the time the LRU has been delivered to the secure storage area.

This formula is based on a liquidated damage of [$25] per day for each LRU that, on the average, exceeds the specified turnaround-time requirement. Such a fixed amount is established and agreed to by the Contractor in recognition of the fact that actual liquidated damages will be difficult if not impossible to determine. Liquidated damages will not be assessed the Contractor for a measurement period if, during the period, each asset demand was met within the specified time period.

In full recognition of the advantages to the Government of an extraordinary turnaround time at the Contractor's repair facility, the Government agrees that if the average turnaround time in a six-month period is less than [seven (7)] calendar days, as computed from warranty data records, an upward contract adjustment shall be made in accordance with the following formula:

$$\text{Bonus} = [\$25] \times ([7] - \bar{T}) \times Q$$

where Q and $\bar{T}$ are as defined in paragraph 11.

12. The Contractor shall have a continuing responsibility to accept for correction and ECP installation, and to complete the correction or ECP installation of, or furnish a replacement for, any LRU shipped to the Contractor's repair facility with a shipping date on or before the last day of the warranty period notwithstanding any other provisions of this warranty. Any replacement LRUs furnished under this warranty must be of the latest configuration and must pass the applicable FV/RTP.

13. The Contractor shall maintain records by serial number for each LRU under warranty as required in Part VI hereunder. These records shall be made available to the Government at the Contractor's plant upon request during the warranty period and for two years following the expiration of warranty.

Part IV - Other Requirements

1. Upon receipt of a returned LRU at the Contractor's repair facility, a joint inspection shall be made by the Contractor and the resident Government quality assurance representative for the purpose of categorizing the warranty status of each LRU and recording the removal ETI of the LRU. The representative shall report to the Contracting Officer all instances where LRUs were determined to be exclusions from warranty. There is a presumption that a returned LRU is covered under this warranty and only the provisions of Part I, paragraph 3 thereof shall void the Contractor's responsibility to repair or replace at no cost to the Government under this warranty. In the event of a controversy, the Government reserves the right to make a final determination as to whether any LRU is covered by this warranty.

2. The Government shall not be obligated to provide facilities, tooling, or equipment of any type for Contractor performance under this

warranty except where Government Furnished Property is identified in the contract.

3. It is assumed that the Government has provided the Contractor with a projected schedule for production and installation by IACS configuration to be used for pricing this warranty. In addition, the pricing of this RIW provision shall be based on an average operating time of twenty (20) hours per month for each IACS LRU delivered to the Government and installed in an aircraft. Starting eighteen (18) months after the initial accounting date (as defined in Part I, paragraph 6) and semiannually thereafter, the contract price shall be adjusted as necessary to account for significant deviations (greater than plus or minus 10 percent) from the projected standard during the six (6) month measurement period. (No adjustment shall be made for an operating differential in the period between contract award and 12 months after the initial accounting date). Such adjustments shall be made by analyzing the elapsed-time-indicator (ETI) readings of all returned LRUs during the six (6) month measurement period to estimate total operating hours and comparing this estimate with the expected total operating hours based on a 20-hour-per-month average.

4. The average operating time per day per LRU (denoted AOT) will be calculated as follows:

$$AOT = \frac{\left(\begin{array}{l}\text{Total elapsed operating hours of all LRUs returned} \\ \text{during the six-month measurement period}\end{array}\right)}{\left(\begin{array}{l}\text{Total installed days for all LRUs returned during} \\ \text{the six-month measurement period}\end{array}\right)}$$

The elapsed operating hours of an LRU returned during the measurement period is defined to be the ETI reading of the LRU when received by the Contractor minus the ETI reading of the LRU when last shipped by the Contractor. The number of installed days on an LRU returned during the measurement period is defined as the total number of days the LRU was installed in an aircraft as determined by the installation and removal data on the LRU, DA Form 2407, or electronic message (in that order) since the date the LRU was last shipped to a Government installation by the Contractor. Since the values in the numerator and denominator of the above equation must be based on the same units, if all required data are not available or if the ETI is not functioning for a returned LRU, then all data pertaining to that LRU shall be excluded from the calculation of AOT.

5. From the projected schedule of production and installation by IACS configuration furnished by the Government to the Contractor, the following values will be obtained for each six-month measurement period:

(1) M_{oi}, the number of LRUs of type i projected to be installed in an aircraft on the first day of the measurement period

(2) M_{6i}, the number of LRUs of type i projected to be installed in an aircraft on the last day of the measurement period

From these values, $\bar{M}_i$, the average projected number of installed IACS LRUs of type i during the measurement period, will be calculated from the equation

$$\bar{M}_i = \frac{M_{oi} + M_{6i}}{2}$$

From the description and number of actual IACS configuration installations reported by the Government at the end of each six-month measurement period (Part II, paragraph 3), the following values will be obtained:

(1) N_{oi}, the number of LRUs of type i actually installed in an aircraft on the first day of the measurement period

(2) N_{6i} the number of LRUs of type i actually installed in an aircraft on the last day of the measurement period

From these values, $\bar{N}_i$, the average number of actually installed IACS LRUs of type i during the measurement period, will be calculated from the equation

$$\bar{N}_i = \frac{N_{oi} + N_{6i}}{2}$$

The expected total operating hours over the six-month measurement period for LRU type i ($EXTOH_i$), based on the projected installation schedule and the average operating time of twenty (20) hours per month for each LRU, will be calculated from the following equation:

$$EXTOH_i = \bar{M}_i \times 20 \times 6$$

The estimated total operating hours over the six-month measurement period for LRU type i ($ESTOH_i$), based on ETI readings of LRUs returned during the period, installed-day measurements and reported number of installations, will be calculated as follows:

$$ESTOH_i = AOT \times \bar{N}_i \times 182.5$$

The usage ratio ($\overline{UR}$) for the measurement period is given by:

$$\overline{UR} = \frac{\sum_{i=1}^{5} ESTOH_i}{\sum_{i=1}^{5} EXTOH_i}$$

and the usage ratio for LRU type i (UR_i) for the measurement period is given by:

$$UR_i = \frac{ESTOH_i}{EXTOH_i}$$

The warranty price adjustment to account for significant deviations in usage from the projected shall be calculated as follows:

(1) If $\overline{UR}$ is greater than or equal to 0.9 and less than or equal to 1.1 ($0.9 \leq \overline{UR} \leq 1.1$), then there shall be no adjustment in warranty price for the six-month period under consideration.

(2) For $\overline{UR}$ less than 0.9 ($\overline{UR} < 0.9$), then P, the potential price adjustment, shall be calculated as follows:

$$P = 182.5 \times \sum_{i=1}^{5} (0.9 - UR_i) \times \bar{M}_i \times K_i$$

where K_i = the average recurring warranty cost per day for LRU type i (to be agreed upon prior to contract award) based on the projected installation schedule and an average operating time of 20 hours per month per LRU.

Should P, as calculated, be less than or equal to zero ($P \leq 0$), then there shall be no adjustment in warranty price for the six-month period under consideration. Should P, as calculated, be greater than zero ($P > 0$), then the downward warranty price adjustment shall be equal to the largest whole number less than or equal to P.

(3) For $\overline{UR}$ greater than 1.1 ($\overline{UR} > 1.1$), P, the potential price adjustment shall be calculated as follows:

$$P = 182.5 \times \sum_{i=1}^{5} (UR_i - 1.1) \times \bar{M}_i \times K_i$$

where K_i is as defined above.

Should P, as calculated, be less than or equal to zero ($P \leq 0$), then there shall be no adjustment in warranty price for the six-month period under consideration. Should P, as calculated, be greater than zero ($P > 0$), then the upward warranty price adjustment shall be equal to the largest whole number less than or equal to P.

6. At the end of each measuring period, an adjustment in contract price shall be made for the unused portion of the remaining warranty for any LRU that has sustained damage attributable by the ACO to the causes and events set forth in Part I, paragraph 3, and is not corrected or replaced under the provisions of Part III, Paragraph 10, or has otherwise been certified by the Contracting Officer as lost or damaged beyond repair. For each LRU for which adjustment is applicable, the contract price will be decreased by an amount equal to RDW $\times$ K_i, where RDW is the remaining number of days of warranty from the day the LRU was declared lost or damaged beyond repair and not replaced, and K_i is as defined in Part IV, paragraph 5.

Part V - MTBF Guarantee

1. IACS is designed to provide a system with extremely high reliability. To achieve this, redundancy has been built into the system in two ways: (1) each IACS configuration has some redundant LRUs, and (2) some of the LRUs have redundant circuits. Furthermore, the testing capability built into the IACS will detect failures within the system which, by themselves, do not constitute system failures. Consequently, an LRU returned to the Contractor's repair facility as a verified failure may contain a failed component but still be capable of performing its intended function. Thus any measurement taken on the basis of these returns will not directly determine the true failure rate of the system nor will it directly determine the true failure rate of any LRU that has redundant circuits. The measurements to be taken in this MTBF Guarantee constitute the mean-time-between-failures (MTBF) within each LRU. From these measurements the MTBF of each LRU and the MTBF of the system including redundancy can be calculated analytically. The Contractor shall provide to the Government the method for performing this calculation, together with all assumptions used in its determination. Following Government approval, the methodology shall be attached to this warranty prior to contract award.

2. The Contractor shall guarantee that the achieved MTBF of the IACS, as calculated in the approved Contractor-provided attachment, is equal to or greater than that shown below:

Period	IACS MTBF
IAD through (IAD + 24 months)	800 hours
(IAD + 24 months) through (IAD + 36 months)	1,200 hours
(IAD + 36 months) through (IAD + 60 months)	1,500 hours

3. The Contractor shall make semiannual measurements of achieved MTBF within each IACS LRU for that six-month measurement period. The first such measurement shall be made at the completion of the first six-month period following the IAD in which the average number of IACS reported to be installed for the six-month period equals or exceeds one hundred (100). Subsequent six-month measurement periods shall follow consecutively. The achieved MTBF within LRU type i ($ALMTBF_i$) is defined as follows:

$$ALMTBF_i = \frac{ESTOH_i}{R_i}$$

where $ESTOH_i$ is as defined in Part IV, paragraph 5.

R_i is the number of LRUs of type i received at the Contractor's repair facility during the measurement period that were verified failures (coded "2" in accordance with Part III, paragraph 2c or changed to a "2" in accordance with Part III, paragraph 9).

All verified failures are to be included in R_i regardless of the sufficiency of any other data pertaining to these LRUs.

4. In the event that the achieved IACS MTBF for any measurement period is less than the guaranteed MTBF corresponding to that period, the Contractor shall furnish to the Government, at no additional cost to the Government, the following:

a. An analysis describing the causal relationship between the achieved MTBF within each LRU and the nonconforming system MTBF

b. Engineering Analysis to determine the causes of the nonconforming MTBF

c. Corrective engineering design changes

d. Modifications of LRUs, as required, at the Contractor's expense

e. Pipeline LRU spares as needed by the Government and determined by the Contracting Officer on a consignment (no-charge loan) basis, but in no event shall the number provided be greater than that provided by the following formula:

$$N_i = (A \times S_i) - (H_i + J_i)$$

where

N_i = the maximum number of consignment spares of LRU type i

S_i = the number of spares of LRU type i currently owned by the Government according to the schedule provided in accordance with Part IV, paragraph 3

H_i = the number of LRUs of type i previously loaned to and retained on a loan basis by the Government

J_i = the number of LRUs of type i previously required on a consignment basis for which liquidated damages were paid in lieu of providing the spare LRU

$$A = \begin{cases} B \text{ if } B \text{ is less than } 1 \ (B < 1) \\ 1 \text{ otherwise} \end{cases}$$

$$B = \frac{G}{M} - 1$$

G = guaranteed IACS MTBF for the measurement period

M = achieved IACS MTBF for the measurement period

5. The objective of consignment LRUs is to support the warranty pipeline flow pending improvement of the MTBF in the nonconforming IACS set. The Contracting Officer, after investigating the causal relationship between the achieved MTBF within each LRU and the nonconforming system MTBF, spares availability, Contractor turnaround-time performance, and Contractor actions and plans for MTBF improvement, will determine the actual

number of consignment spares of each LRU type to be provided by the Contractor in the event a guaranteed MTBF value is not achieved; but in no event shall the actual number exceed that provided by the formula in Part V, paragraph 4 above. If, in the opinion of the Contracting Officer, the causal relationship provided is accurate, and based on that relationship, one (or more) LRU types had no impact on the nonconforming system MTBF, and there were sufficient assets of that LRU type in the secure storage area during the measurement period to meet each asset demand within the time period specified in Part III, paragraph 7, then consignment LRUs for that LRU type shall not be required.

6. In the event consignment LRUs are to be supplied by the Contractor to the Government, the Contractor shall ship such LRUs to the Government as soon as reasonably possible but no later than sixty (60) days after the Government notifies the Contractor of the number of consignment spares of each LRU type required. If the Contractor is unable to supply consignment LRUs within the 60-day period and the failure to do so arises out of causes beyond the control and without the fault or negligence of the Contractor, the Contracting Officer has the right to grant an extension to the 60-day requirement. Clear and convincing evidence must accompany any request for such extension. For each consignment LRU not supplied within the appropriate period, the Contractor will be assessed liquidated damages at the rate of three and one-third percent (3 1/3%) of the most recent LRU price each day late. In no event, however, shall the liquidated damages associated with any specific MTBF measurement period for any individual IACS LRU be more than the most recent price for such an LRU. The "most recent price" is defined as the most recent production price as it has been revised to reflect any equitable adjustment thereto.

7. In the event LRUs have been consigned to the Government and N_i as calculated in paragraph 4e hereof is negative, all or a portion of such consignment LRUs and up to fifty percent (50%) of the liquidated damages paid in lieu of consignment LRUs will be returned to the Contractor according to the following formulas:

a. The number of consignment LRUs of type i to be returned (W_i) is determined from

$$W_i = (H_i + J_i) - (A \times S_i)$$

If W_i, as calculated, is greater than H_i ($W_i > H_i$) then W_i shall be redefined to equal H_i

b. The amount of liquidated damages paid in lieu of consignment LRUs to be returned to the Contractor will be 0.5 × (most recent price for LRU type i) × $[(H_i + J_i) - (A \times S_i) - W_i]$ up to a maximum of fifty percent (50%) of the total liquidated damages paid for that LRU type.

8. The Government will return the number of consigned LRUs determined in Paragraph 7 as soon as possible but no later than sixty (60) days after an MTBF measurement indicates that such return is required. The LRUs returned shall be operable and shall be either the actual LRUs provided by the Contractor or equivalent LRUs provided under this contract. In the event that such LRUs are not shipped to the Contractor within sixty (60) days, the Government shall pay the Contractor an amount equal to three and one-third percent (3 1/3%) of the latest LRU price for each day exceeding sixty (60) days, up to a maximum of the most recent LRU price. The "most recent LRU price" is defined as the "most recent production price as it has been revised to reflect any equitable adjustment thereto." Excess consignment LRUs not shipped by the Government within ninety (90) days shall become the property of the Government upon full payment of the amounts specified in this paragraph.

9. All LRUs still on consignment to the Government after the MTBF guarantee provision terminates shall become the property of the Government at no additional cost to the Government unless an extension of the MTBF provision is negotiated. Consignment LRUs that are in the Government inventory, or that become the property of the Government through the provisions of paragraph 8, above, shall be subjected to all provisions of the reliability improvement warranty and MTBF guarantee clause of this contract as appropriate at no increase in contract price. The warranty expiration date for such LRUs shall coincide with the warranty expiration date existing on the contract.

10. In full recognition of the advantage provided the Government if the achieved MTBF of the IACS is extraordinarily high, the Contractor may qualify for an upward contract price adjustment at the completion of the RIW period. To qualify, the achieved MTBF of the IACS must have exceeded [2,000] hours for the last two measurement periods. The amount of the price adjustment shall be determined by the Contracting Officer, but in no event shall it exceed ten percent (10%) of the RIW price.

Part VI - Data Requirements

The Contractor shall establish and maintain a data accumulation, processing, analysis, and reporting system capable of providing the information required by the following data items:

CDRL 001	Plan for Warranty Notice, Labels, and Seals
CDRL 002	Data Collection and Analysis Plan
CDRL 003	Warranty Data Report
CDRL 004	Warranty Effectiveness Report

ATTACHMENT

RIW DATA ITEMS

The Contract Data Requirements List (CDRL) DD 1423 form and supplemental instructions for items required to support RIW are included in this attachment.

ATCH NR _____ TO EXHIBIT _____ CONTRACT DATA REQUIREMENTS LIST SYSTEM/ITEM IACS

TO CONTRACT/PR _____ CATEGORY _____ CONTRACTOR _____

1. SEQUENCE NUMBER	2. TITLE OR DESCRIPTION OF DATA / 3. SUBTITLE	4. TECHNICAL OFFICE	10. FREQUENCY	12. DATE OF 1ST SUBMISSION	14. DISTRIBUTION AND ADDRESSEES (Addressee – Regular Copies/Repro Copies)
5. AUTHORITY (Data Item Number)	6. CONTRACT REFERENCE	7. DD 1423 REQ	11. AS OF DATE	13. DATE OF SUBSEQUENT SUBM/EVENT ID	15. TOTAL
001	2. Assessment Program Plan 3. Plan for Warranty Notice, Labels, and Seals	4. W15P82	10. O/TIME	12. 60 days ADAD	14. W15P82
DI-R-1750		DD			15. TOTAL
16. REMARKS: Delete Block 10 Preparation Instructions on DD Form 1664. Prepare in accordance with Part III, paragraphs 1, 2, and 3.					
002	2. Assessment Program Plan 3. Data Collection and Analysis Plan	4. W15P82	10. O/TIME	12. 120 days ADAD	14. W15P82
DI-R-1750		DD			15. TOTAL
16. REMARKS: Delete Block 10 Preparation Instructions on DD Form 1664 Prepare in accordance with supplemental instructions					
003	2. Assessment System Perf. Status Rpt. 3. Warranty Data Report	4. W15P82	10. Semi-Annual	12. See Block 16	14. W15P82
DI-R-1753		DD			15. TOTAL
16. REMARKS: Delete Block 10 Preparation Instructions on DD Form 1664. Prepare in accordance with supplemental instructions Submitted in accordance with supplemental instructions					
004	2. Assessment System Perf. Status Rpt. 3. Warranty Effectiveness Report	4. W15P82	10. Annual	12. Block 16 See Block 16	14. W15P82
DI-R-1753		DD			15. TOTAL
16. REMARKS: Delete Block 10 Preparation Instructions on DD Form 1664. Prepare in accordance with supplemental instructions Submittal in accordance with supplemental instructions					

PREPARED BY	DATE	APPROVED BY	DATE

DD FORM 1423 REPLACES EDITION OF 1 APR 67 WHICH IS OBSOLETE PAGE ___ OF ___ PAGES

17. EXHIBIT/ITEM NUMBER	23. CONTRACTOR FILE/DOCUMENT NUMBER
18. SOO APPROVAL/WAIVER NUMBER	24. ESTIMATED NUMBER OF PAGES
19. 20. 21. 22. RESERVED FOR ADP	25. PRICE GROUP
	26. ESTIMATED TOTAL PRICE
CONTRACT VALUE	

SUPPLEMENTAL INSTRUCTIONS FOR CDRL 002

1. This plan will detail the data records to be maintained and the procedures and reporting formats to be used by the Contractor to provide the RIW reports required by this contract.

2. This report will identify the basic forms that are to be used to collect data, the data items to be maintained, and the format of the data records. As a minimum, the following information will be included for each LRU returned:

a. Serial number

b. Aircraft type in which installed

c. Installation date

d. Removal date

e. Organizational unit code

f. Date electronic notification received

g. Date replacement shipped

h. Date received by Contractor

i. Date joint inspection performed

j. ETI reading when received

k. Result of joint inspection to include warranty status category code

l. Probable failure cause

m. Action taken for repair

n. Cost of repair

o. Date of successful completion of FV/RTP

p. Date stored in secure storage area

q. Date shipped to a Government installation

3. The report will identify the data processing steps that will be used to transform the data identified into the required outputs for this contract. The report shall address in detail processing related to calculation of the following parameters:

a. Contractor turnaround time

b. Achieved IACS MTBF

c. Actual usage rate

d. Warranty price adjustment factors

e. No-trouble-found ratio

4. The report shall identify the format of other RIW-related reports. Sample heading sheets, data listings, and supporting narrative shall be included as appropriate to illustrate the selected formats.

SUPPLEMENTAL INSTRUCTIONS FOR CDRL 003

The Contractor shall provide a semiannual Warranty Data Report covering warranty experience over each six-month reporting period. Such reports shall be delivered to the Government within 60 days from the end of the reporting period. This report shall, at a minimum, contain the following:

a. IACS Initial Delivery: a record, by serial number, of each IACS LRU showing ETI, date of shipment, and shipping destination.

b. Corrective Action Summary: a record by serial number of corrective actions of IACS LRUs showing originating field activity (if available), ETI reading, date of receipt, Contractor corrective action, warranty coverage applicability, and date of repair completion.

c. IACS Secure Storage Area Population: a listing of the number of each type of LRU in the secure storage area at the end of each month in the reporting period.

d. LRU Cycle Time: to the extent practicable, a summary and analysis, by LRU type, of the number of days for the major elements of the corrective cycle as follows:

Contractor receipt

to

Storage in secure storage area

to

Shipment to Government activity

to

Installation in aircraft

to

Removal from aircraft

to

Shipment to Contractor

to

Receipt by Contractor

e. IACS Reliability: a summary and analysis of the operational field reliability, including MTBF measurements by LRU type and, to the extent possible, mean-time-between-removals information. Analysis of causes, modes, trends, and patterns of field failure and actions taken, recommended, or projected for corrective action shall also be included. To the extent possible, the effects of varying field environment (e.g., aircraft type) on operational reliability shall be investigated.

f. Modification Status Summary: a summary of modifications recommended and incorporated by the Contractor for reliability and maintainability improvement and a record by serial number of the modification status of each delivered LRU.

g. Warranty Population: a monthly summary by LRU type of the number of LRUs known to be in the Government inventory under warranty, listed according to the amount of remaining warranty period. Information concerning lost LRUs or LRUs declared nonrepairable should be summarized.

h. Contract Price Adjustment and MTBF Guarantee Statistics: a record of measurements and calculations necessary for implementing the provisions pertaining to contract price adjustments and the MTBF guarantee provision. To be included are the following:

(1) Percentage of returns with unverified failure

(2) Average turnaround time

(3) Operate-time measurements

(4) Number of lost LRUs

(5) LRU MTBFs and set MTBFs

(6) Average installed population

(7) Number of returns

(8) Number of returns categorized as unverified failures

(9) Number of demands not met within specified time period

(10) Consignment-spares adjustment (if applicable)

(11) Hours-of-operation adjustment

(12) Monetary penalty

(13) Cost of exclusion repairs (itemized)

i. Other pertinent data, facts, information, and investigations that the Contractor, at his discretion, believes will be of value to the Government in implementing and expanding the RIW and MTBF guarantee concepts.

SUPPLEMENTAL INSTRUCTIONS FOR CDRL 004

The Contractor shall provide an annual Warranty Effectiveness Report. The first such report shall cover the period from contract award to 24 months after the initial accounting date and shall be delivered to the Government within ninety (90) days from the end of that period. Subsequent reports shall be issued annually. The Warranty Effectiveness Report shall contain:

a. A report of experiences and conclusions regarding the effectiveness of the warranty concept applied to this contract

b. Recommendations and suggestions regarding warranty-clause provisions that may be of mutual benefit to the Government and industry in future procurements

c. Recommendations on methods to reduce returns of unverified failures

d. Recommendations on how to reduce exclusion returns

e. Recommendations on how to reduce pipeline time