Process To Improve Reliability Of A Complex System Of Mature Design

By

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A MASTER OF ENGINEERING REPORT

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An endeavor such as this master's degree is not possible alone. I want to thank Hector Reyes, for doing it first, then encouraging me to follow. Many thanks go to Tom Heath, who understood how important this was to me, and valiantly tried to ease my workload to make time for my coursework. With two of his four SEs in this program, that was a tough task. To Jerry Weible and Dave Davenport, my thanks for access to all the data and answers to all my questions. I wish to thank my coworkers who accommodated my schedule for the past year, and to Raytheon for reviving this program and encouraging us to continue to reach our educational goals.

I would like to thank Dr. Atila Ertas for his help in making this program succeed. His understanding of our need to balance full-time study and full-time jobs helped keep us on track. I would also like to thank the other members of my committee, Dr. Timothy Maxwell, Dr. Murat Tanik and Dr. John Borrelli, for their helpful direction and advice.

Next, I have to thank my study group – Davinia Chism, Kurt Himmelreich, and Donna Maestas, -- classmates, coworkers and friends. They gave me a sympathetic ear when needed, a swift kick when needed, and humor to keep me sane. Davinia, the journey certainly has been eventful.

I would like to thank my late Father for his love and support throughout the years. His engineering career sparked my interest in all things technical. He was my rock.

Lastly, I would like to thank my Mother for her love and for her insistence that all 7 of her children get a college education. She is 7 for 7 -- 3 nurses, 3 engineers and an accountant. This makes the third masters degree among us. Thanks, Mom, for everything.

JCC

DISCLAIMER

This report is to be considered a generic approach to methodologies for increasing the reliability of a complex, mature system from a Systems Engineering viewpoint. It will not be an all-inclusive how-to guide, but rather a vehicle for stimulating new ideas and approaches. The opinions expressed in this paper are strictly those of the author and are not necessarily those of Raytheon, Texas Instruments, Texas Tech University, or any U.S. Government agency.

PERMISSIONS

Email Traffic Between Wayde Tomka, HTI Project Leader, PM FLIR, Gene Gordon, HTI Project Manager, Raytheon Company, and the author.

From: "Thomka, Wayde W Mr PM-NV/RSTA" <wayde.thomka@nvl.army.mil>
To: jeanc@raytheon.com
Cc: "'Gene Gordon'" <e-gordon2@raytheon.com>, "Vuille, Alison R Ms PM-NV/RSTA" <alison.vuille@nvl.army.mil>
Subject: RE: Masters Project Proposal
Date: Thu, 18 Apr 2002 13:50:34 -0400   04/18/2002 12:49:49 PM

A thorough documented evaluation intended to improve our system reliability, at no cost to the USG! I too fully endorse the activity.
Good luck Jean, look forward to reading the results.
Wayde W Thomka
Project Leader SGF
(703) 704-3441
-----Original Message-----
From: Gene Gordon
Sent: Wednesday, April 17, 2002 3:09 PM
To: wayde.thomka@nvl.army.mil
Cc: jeanc@raytheon.com
Subject: Masters Project Proposal

I know Jean has talked to you about this and I just wanted you to know I fully endorse this, it'll help all of us to make our systems better.
Thanks in advance for your permission. Tks, G2
----- Forwarded by Gene Gordon/US/Raytheon on 04/17/2002 02:00 PM -----
Jean Cathcart
<jeanc@raytheon.com To: e-gordon2@raytheon.com
Subject: Masters Project
Proposal
04/17/2002
01:32 PM

Gene,
Attached is a proposal for my Systems Engineering Masters Project, a requirement for my Masters degree.
Please read it and comment. I would like to send this to PM FLIR, with your approval, to seek their permission.
Regards,
Jean Cathcart
(See attached file: Masters Project_Cathcart.doc)

Attachment to Above Memo

Proposal for Masters Project
For
Masters in Engineering
Texas Tech University
by
Jean Cathcart

Introduction
A proposal for my Systems Engineering Masters Project is to devise a process to improve the reliability of a complex system of mature design, using the NV-80 B-Kit as my test case. My project will include only unclassified B-Kit information.

Methodology
Almost all literature that I have examined states that to improve Reliability in a mature system, major design changes and process changes are required. The current B-Kit hardware and its failure rates, both in-house testing fails and field fails, will be examined in a precise and logical fashion. Once data is examined, candidates for change will be determined. Then the cost and schedule implications will be examined. Once design change/process change recommendations have been made and implemented, reliability will be tracked to gauge improvement. A method for measuring improvement will be devised as part of the project.
Since time is short, I will use those design changes currently being implemented but not yet tested, and recommend further design changes.

Project Submittals
The submittals necessary to satisfy the Masters Report requirements are:
Project Presentation – a 20-minute presentation describing my project, its applications and outcomes. This is an open presentation, anyone can attend. The audience will probably consist of my fellow students, who are all engineers at Raytheon, some Raytheon project managers invited to provide questions and comments, and some University Professors who will evaluate my presentation for grade. The presentation is scheduled for October 12, 2002.

Project Report – This is a 100-200 page document that shows all aspects of my project: all data collected, calculations, diagrams, process descriptions, design/process change recommendations, conclusions, etc. This will become a public domain document, and will reside on a Texas Tech University Web Site that can be accessed anyone. This report due date is November 1, 2002.

My time for this project is of no cost to either PM FLIR or the Raytheon HTI group. If this project is approved, both PM FLIR and Raytheon will receive copies of the Project report.

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ABSTRACT

A number of factors have combined to create reliability problems in today's systems. The shear complexity of the system, the use of off-the-shelf parts instead of MIL-SPEC parts, and the shorter time from conception to fielding all can lead to reductions in system reliability.

This report will explore ways to improve the reliability of a complex system of mature design; a system consisting of more than 1000 piece parts and has been in production for more than 2 years. A generic methodology is proposed, then is implemented on the NV-80 B-Kit as an example. The proposed methodology inludes ideas on improving failure data collection, improving reliability through process control, through strategically place Quality Inpection points in the manufacturing process, and through using Design for Reliability techniques and software tools during any redesign work.

The degree of success of this example has not been determined as of the writing of this paper, but every step has been completed up to starting the next Reliability Growth Test. The test is progressing. A list of future activities for the example is included.

Chapter 1
Introduction

Reliability is a requirement, and a significant portion of the cost, in almost all U. S. Government (DoD and NASA) contracts [Malcolm]. There are many definitions for System Reliability. A general form that will be used for this report is “the probability that a …system performs its purpose adequately for the period of time intended under the operating conditions encountered” [Billinton].

A full reliability qualification test (RQT) can cost millions of dollars, and never verify the reliability requirement of the system. A more analytical approach is the Reliability Growth Test (RGT), where statistics are used to determine a starting reliability number for the system, then anticipate a growth curve for the system reliability. As the test progresses, this growth curve is either validated or recalculated, depending on system performance over time. A RGT continues even though failures occur. Corrective action is implemented, and the test continues. The success of this corrective action determines the growth curve. In a full RQT, if a failure occurs the test is done, and the system failed. The system is repaired and the test is started from the beginning. This cycle is what is so expensive about RQT.

If the reliability of a system is modeled using available parts reliability information from public and government sources, and the reliability prediction is high, what happens when a test is performed, and the system reliability numbers are much less than predicted? And what if a new contract is signed with even HIGHER reliability requirements?

The author was presented with the challenge of taking a production system whose design is complex (over 50,000 parts) and increasing the reliability of the system by over 100% -- a truly daunting task. Literature searches, subject matter experts and government resources turned up much information on how to design a reliable system, on how to predict reliability, on how to calculate reliability, and on how to control the manufacturing process with the aim of speeding up production. But little information was found on how to take a system whose design is stable, but whose reliability is too low, and improve the reliability. A methodology to do exactly that, with a more realistic idea of how large that increase can be, is documented here. More than 100% reliability increase is impossible; An increase of 20% is a desirable and reasonable goal.

Chapter 2

Background

Prior to World War II, reliability of an item was hard to quantify and never high enough to please the end user. The use of statistical methodologies to estimate length of useful life of railroad equipment began in the early 1900's [Blischke, p 19]. For consumer products, quantitative reliability methods, in the form of actuarial studies, were employed as the popularity of product warranties grew in the 1950's [Kececioglu p 48]. For the military, a more rigorous and formal approach to product reliability grew out of the experiences of World War II, the first major battles to regularly use complex military systems (planes, field radios, radar, automatic weapons) [Blischke p 19]. During those battles, 60% of electronic equipment arrived damaged; 30% damaged beyond repair, 50% of the spares in storage became unserviceable before use, electronic gear on bombers had a maximum expected life of 20 hours [Kececioglu p 43]. Shortly after WWII, several individuals, either in the military or as civilian help to the military, made initial steps to integrate reliability into military purchases. These attempts slowly percolated to the top of the military ranks.

Gen. George C. Marshall, then Secretary of Defense, issued a major directive in Sept, 1951 to all branches of the military to increase their emphasis on the reliability of military electronic equipment [Kececioglu p 44]. As dependence on electronics increased, it became crucial for the equipment to work reliably for longer periods of time. In 1954, General Dynamics signed a contract to develop the Atlas Ballistic Missile, the first military contract containing a quantified reliability requirement [Kececioglu p 45].

As system complexity increases, reliability decreases. Consider the simple farm tractor. In 1960, the basic Ford tractor had 2250 parts. In 1990, that same base model had 2900 parts and its reliability had decreased from 79.9% to 74.8%, an extra 51 fails per year per 1000 tractors [Blischke p5]. If individual component reliability is 99.999% , and an assumption is made that all components are necessary for the system to function (series reliability), then if the system has only one component, the system reliability is 99.999%. However, if the system has two components, the system reliability is calculated as

$$R_{system} = R1*R2 \qquad \text{[Ertas, p342]}$$

Where R1 = Reliability of Component 1, R2 = Reliability of Component 2

In this case, the reliability would be 99.998%. If the system consists of 10,000 of these components, the system reliability would drop to 90.48% [Kececioglu p5]. Table 1.1 compares the system reliability for components with 99.999% and 99.99% (3 decimal places vs. 2) reliability as the number of components making up the system increases.

Table 2-1. System Complexity and Effect on System Reliability

Number of Components in series	99.999% Individual Component Reliability	99.99% Individual Component Reliability
	Overall System Reliability (%)	Overall System Reliability (%)
100	99.90	99.01
250	99.75	97.53
500	99.50	95.12
1,000	99.01	90.48
10,000	90.48	36.79
100,000	36.79	0.01

Table from [Kececioglu p5].

In today's military, systems routinely average in the millions of parts [RAC4], and reliability is becoming increasingly difficult to preserve.

For the military, reliability is a double-edged sword. Systems must be reliable or the U.S. loses its strategic advantage and people die. However, higher reliability almost always translates into higher initial costs, usually so high the weapon system becomes unaffordable. Thus, reliability considerations are often shoved into the background to allow the new system to be priced within the current year's military budgets. The longer the delay in considering reliability and maintainability principals in the development process, the more costly the system ultimately becomes [Bentley].

In the last two decades, as the speed of technological change increased, the military had to abandon its traditional "Military-Standard" approach to systems development [DoD3]. In the 50's, 60's and 70's, the military developed new systems slowly, using detailed Military Standards for every part, every process, every test and every assembled system. Development of a new system took 10 - 15 years, and the system was expected to function reliably for 20 -30 years. With today's increase in the pace of changing technologies, by the time a weapons system designed at this pace reaches the soldier, it is obsolete [DOD3]. Today's military has moved to a much shorter development cycle and has gone to Common-Off-The-Shelf (COTS) technologies. The military has abandoned many of the military standards, or relegated them to the 'information only' or 'suggested use' portions of most contracts.

Because of the rise in demand for reliable systems, many methodologies for estimating reliability have been developed. The most popular are the Bayseian and Weibull models [RAC3]. Both of these models use statistics, material science and published data to predict component reliabilities, and extrapolate those component reliabilities into an overall System reliability. The Weibull model is the most popular in use today, because it uses a shape factor to account for otherwise unaccounted-for factors (manufacturing deviations, material deviations, use deviations) [RAC3]. This shape factor is derived by plotting actual component failure data on special Weibull plotting paper. [Ertas, p340]. Most models usually over-estimate system reliability when compared to field reliability data [RAC1].

The increases in computer capabilities have lead to the development of several software programs that estimate System reliability. For the most part, the engineer simply inputs manufacturer's part numbers for all components used, the software looks up the "published" reliability data for that part, and computes an overall system reliability [RAC3]. These programs do not take into account the usage environment, thus over-estimate the final reliability numbers. Some software programs allow the user to input project failure data to enhance the modeling of parts reliability for a particular use or environment [Dylis]. The program the author became most familiar with during research was the PRISM® software developed by RAC [RAC4 and Dylis].

Design for reliability, the idea that reliability as well as functionality should drive parts selection during the design process, has had a lot of press. An Air Force Initiative, R&M 2000, was centered around improving reliability and maintainability (R&M) by bringing rhose concepts into stronger consideration during the design process [Malcolm]. As designs become more complex, this becomes harder to do. There may be no alternative parts for a specialized application, so a component is selected that has a low reliability estimate [Trewn].

The use of Highly Accelerated Life Test (HALT) and Highly Accelerated Stress Screening (HASS) to determine design weaknesses is advocated in the design verification process [Hobbs]. These processes were designed to aid commercial electronics product design, and use rapid changes in temperature, vibration and shock to induce part failures [Hnatck]. However, this strategy has some limitations. The size of the system, the harsher than normal military vibration and shock environments, and use of forced air all limit the effectiveness of HALT and HASS on military systems [F. Wang].

Other methods for increasing reliability in the design phase and manufacturing phase have been investigated: Taguchi methods [Bierbaum], Design of Experiments [Hamada], Process Control [James]and [Sharp], and Configuration Management [Boznak]. Studies have even been done into the human/machine interactions in the factory as a way of improving reliability [Greenburg].

While researching methods for increasing reliability on a system that is well past the design phase, the author found limited literature. Information was available on Production Process Improvement. While these theories brought about immediate, though short-lived, improvement in reliability, they showed limited success in improving reliability over the long term as people were replaced or lost motivation [Sharp]. Most information centered on redesign of parts or subsystems that were known to be reliability problems [Al-Khowaiter]. No literature was found that combines many of these processes, or that suggests alternate methodologies.

The methodology proposed in this report will employ pieces of many of the above investigations and add other items to enhance the probability of success in our attempt to improve the reliability of a complex system of mature design.

PART A GENERIC METHODOLOGY FOR RELIABILITY IMPROVEMENT

Chapter 3

Proposed Generic Methodology

The proposed methodology for increasing the reliability of a complex system of mature, stable design is based on the idea that the project or customer has collected failure data over the life of the program. If root cause and corrective action for each failure has also been tracked, this will make the process more effective. The failure data should be as exhaustive as possible, but must cover at least two years of production, testing and fielded use. Use of failure data covering a lesser time frame, or only one part (i.e. testing), may yield skewed failure analyses results.

Some thought must be given to the cost of this undertaking. We live in a world where cost is the driver. The economic reality is that the payback period of any system redesign is long term. Expecting short-term payback for extensive system redesign is unrealistic. The payback period will be in the 2-3 year time period. If the anticipated life of the production contract is not at least that long, it is not economically feasible to begin such a large-scale redesign. Smaller steps, outside the scope of this paper, are a better economic choice if production is expected to end in the 2-3 year timeframe.

The proposed generic methodology to increase system reliability is shown in Figure 3-1. Failure data will be used to calculate current system reliability, and also will be used to determine which subsystems or components need to be changed to improve reliability. Candidates for either design change or process change will be selected, then costed, and cost/benefit trade studies will be performed. Cost-effective changes will be implemented. Systems built with the new design under the new processes will be tested using several methods and failure data will be collected. A new system reliability will be calculated and compared to the initial reliability. Cost savings expected from fewer failures will be calculated and compared to the cost of implementing changes and any cost or reliability progress will be documented. This process can be used continuously improve the reliability of a system. Each step of the proposed process in Figure 1-1 will be discussed in more detail.

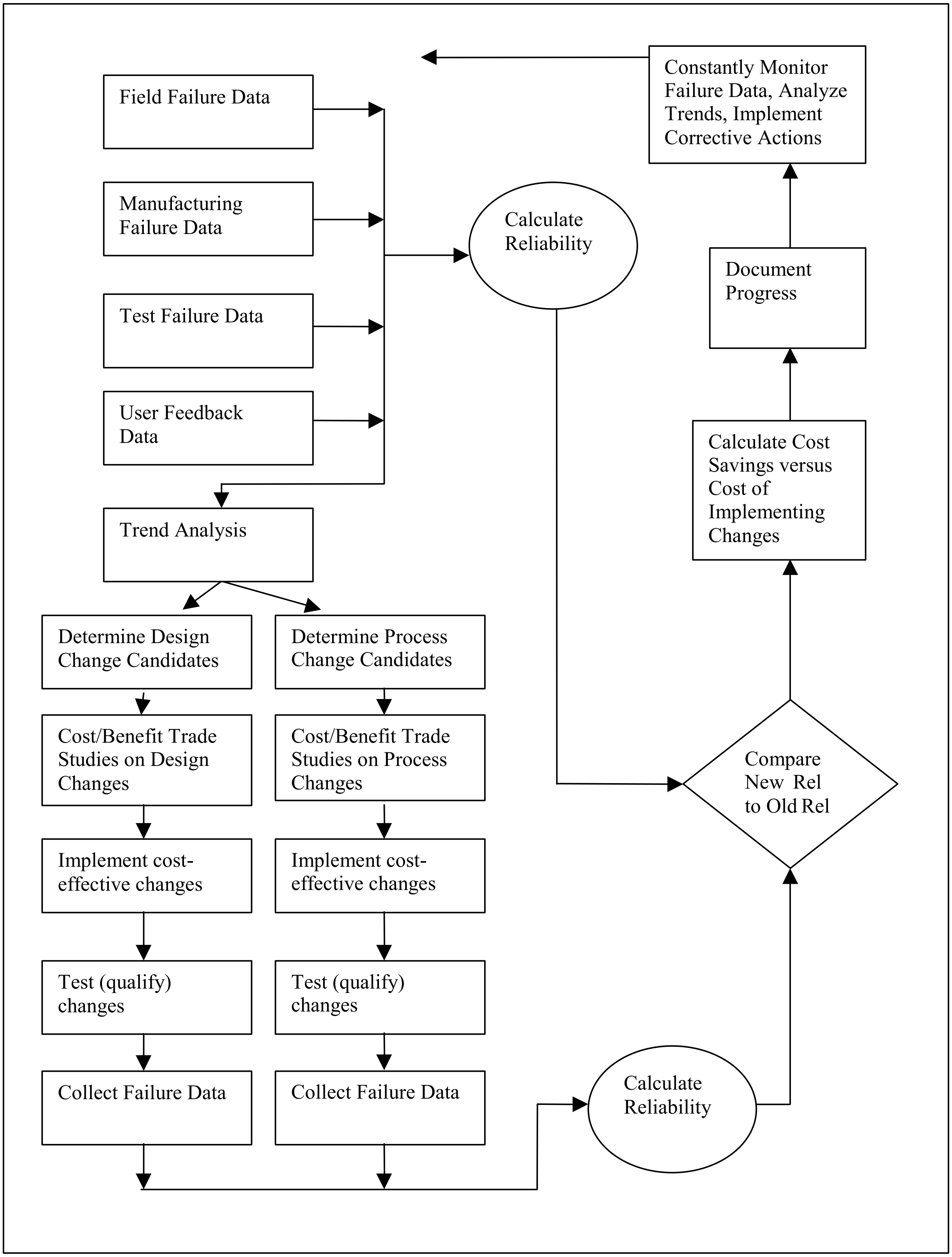


Figure 3-1. Process Flow Diagram

3.1 Failure Data

Failure data for a complex system must be rigorously captured in a systematic manner. Electronic capture of failures works best, as human error is minimized. Unfortunately, this is costly, as customized software is required. Whether failure data is captured automatically or is hand-entered by individuals, a uniform language must be used. Failure symptoms, root cause verbage and corrective action language must be limited enough to maintain control of the database, but must be broad enough to capture the details of each failure. For hand-entered data, a list of standard choices should be provided to the technician, i.e. boxes to check.

3.1.1 Test Failure Data

Of all the data collected, the Test Failure data will probably be the most complete, and the most detailed. It is also the most useful in improving reliability. Test data is collected on units that have passed all of the manufacturing gates, so material handling errors, part installation errors, and “bad out-of-the-box” failures have all been weeded out. Test failure data detail is due to the attention a test failure, especially a Qualification Test failure, garners from both the military customer and the project management. Test failures usually occur in front of an audience (DCMA test witnesses, customer demonstrations, management exhibitions, etc). This alone is cause for intense root cause analysis, so that the failure can be explained to the customers’ and management’s satisfaction.

A formal failure reporting system should be in place during testing. Suggestions are RFR (Reliability Failure Reporting), FIAR (Failure Incident Analysis Reporting) or FRACAS (Failure Reporting, Analysis and Corrective Actions System). RFR is a system for simply recording all failures encountered, not necessarily for requiring failure analysis to root cause, or for requiring corrective actions. FIAR is a system for recording failures, and for analyzing the root cause of the failure. This system does not necessarily force corrective action. This system is the most user-friendly and flexible for testing purposes. FRACAS is a closed-loop system of data collection, analysis and dissemination. It helps to identify and correct failures of both product and process, and is especially useful in a manufacturing environment. Because it is the most useful and the most automated, it is also the most expensive. “FRACAS is one of the most valuable tools of reliability engineering. While it is always better to prevent problems, it is vital to identify and correct…problems which do occur…” [DoD3].

3.1.2 Manufacturing Failure Data

The collection of manufacturing failure data is the second important step in improving system reliability. It is not always as useful as test data, because it contains “infant mortality” failures, material handling failures and parts installation errors. These are all useful information, and should be considered in the overall process to improve reliability, but should be weighted accordingly. The manufacturing failure data is important to the reliability improvement process because it shows three important items: 1) Which manufacturing processes have the most fails, 2) Which parts have the highest bad-out-of-the-box type failures, and 3) Which subsystems have the most failures during the manufacturing/assembly process. These items will be scrutinized to determine which processes can be improved, which parts or parts manufacturers should be changed, and which subsystems may be too difficult to assemble as designed, and should be candidates for design change.

Again, a rigorous, well-managed system must be implemented for collecting failure data. The use of a relational database for managing the categorization and status of failures is essential [James]. Some suggestions are FRACAS (see paragraph 3.1.1), FMS (Failure Monitoring System), and SFSMS (Shop Floor Stoppage Monitoring System). Each data system has automated methods for collecting failure data, most must be manually input. Each relies on humans to input data correctly and completely for the data system to work properly. The US Military prefers the FRACAS software system [DOD3].

3.1.3 Field Failure Data

For military equipment, field failure data is the hardest to collect, but the most important to truly assess the reliability of a system. It is the most difficult to collect because the system is being used, usually in a remote location, and usually in a time of crisis. This situation does not lend itself to accessing a computer to input failure data, the user is busy with more important tasks, such as surviving with a failed system. Unfortunately, some field failures are never documented because the user didn't live to access that computer. Most field failures are documented well after the failure has occurred, and important failure details are lost.

Field failure data is the truest measure of system reliability because the system is being used for its intended purpose in its intended environments by its intended users. No test in a laboratory, no matter how well planned and executed, can duplicate this usage [W. Wang]. This usage is what the customer envisioned when the reliability requirements were set forth in the contract, and this usage is what the system should have been designed to withstand.

Again, a rigorous system must be implemented for collecting failure data. It would be easiest on the Reliability engineer if the system used by the customer in the field was the same software used in both the testing and the manufacturing processes. This should be set up with the customer as part of the contract negotiations. In this case, FRACAS is the recommended tool.

3.1.3 User Feedback

User feedback is usually in the form of design change suggestions, not failure data. The users know what works well and what needs to be changed in a system. For example, a handle sticks out from the system, and is in the perfect spot to impact the user's elbow during operation. The handle doesn't get broken during this impact, so is never reported as a system failure, but it definitely affects the ability of the user to complete his task using the system. These kinds of design change suggestions should be considered during any redesign phase of the system. The cost of the improvement has to be weighed against the benefits of the improvement, so trade studies are performed on user suggestions of merit.

3.2 Calculate Current Reliability

The next step in the process is to calculate the current system reliability. This can be done in several ways, and is usually specified by contract. If total system operational hours, including test on-time hours, manufacturing on-time hours and field on-time hours, are known or can be reasonably estimated, then the calculation for instantaneous Mean Failure Rate (iMFR or iλ) is simply the total number of failures divided by the total on-time [Bentley]. The iMFR is the reciprocal of the instantaneous Mean Time Between Failures (iMTBF). The iMFR or iMTBF calculation is the "brute force" approach. Any good Reliability engineer will decry this method of reliability measure, because it does not take into account all the subtleties of the Reliability science, such as Hard or Soft, Mission Affecting or Non-mission affecting, Relevant or Non-relevant. In a pure Reliability Qualification Test (RQT) or Reliability Growth Test (RGT), these nuances play an important role. However, when the number of failures is this large and the timeframe this long, the subtleties get steamrolled.

All good reliability requirements have are worded similar to the following : A 90% probability of completing a 60-hour mission without failure when operated in the environments specified in Table ?? with a confidence level of 80%. This equates to an MTBF of 520 when an exponential distribution is assumed [RAC5].

Again, back into the usually important Reliability science nuances. A confidence level is a statistical measure of the probability that a number will fall within two limits [Kececioglu, p69]. The 90% probability is the initial assessment of completing the mission. Anything over 50% is better than average. The 90% is high probability of success, something most military types like. An exponential distribution is another statistical measure, a way of looking at the probability curve and confidence interval.

Another failure calculation methodology is to divide the total number of failures by the total possibilities for failure [RAC3]. This is a less desirable method, in that it does not adequately account for aging and usage of the system.

3.3 Trend Analysis

Once failure data is collected, it must be analyzed. The first parsing question should be 'Is this a true failure?' If the failure was caused by operator error, test equipment error or other non-system error, it is not a true system failure and should not be counted in the reliability assessment. These failures are important and must be considered in arenas outside the scope of this paper, such as training, test equipment design and design of tests.

There are many methods for "Slicing and Dicing" of failure data [James]. Slicing by failure category or by subsystem may give more insight than slicing by time. Keeping the databases separate, so that manufacturing data is looked at independently, test data is looked at independently, before merging into the larger database is another way of analyzing the data. This aspect of the trend analysis is impossible to pin down, because it is data dependent. Each system, and its associated failure database, will require multiple different slices to determine the best method to gain the most information from the data.

After all of the slicing and dicing are completed, some pictorial methods of presenting the failure data are necessary. Line graphs, Pareto charts, Pie charts, scatter charts are all acceptable methods for representing the failure data. From these charts, a clear picture of those subsystems and components that are the highest failure items over the life of the project will emerge. These are the items that become Design-Change or Process-Change Candidates. Figure 3-3-1 shows an example of a bar chart of failures.

3.4 Design-Change and Process-Change Candidates

Those subsystems or components that show the highest failure rates must be looked at more closely. Why are they failing at higher rates? What do the root causes show? If the root cause of the failure is workmanship, then a manufacturing process needs to be changed, and/or the part needs to be redesigned to reduce workmanship failures. This is the method by which Design-Change candidates and Process-Change candidates are selected. Those items that show the highest failure rates should each be examined to determine how best to eliminate those failures. In Figure 3-3-1, Resistor 155 and Resistor 157 are Design-Change candidates, and Capacitor 2112 is a Process-Change candidate. The other two components are not change candidates because their failure rate is small by comparison.

Historically, process changes are the cheapest, easiest and fastest to implement, but process changed only provide short-term reliability improvement. As people change jobs, leave the company or lose motivation, the process changes again, usually for the worse [Sharp]. The only way to provide long-term reliability improvements is to build them into the system via design (hardware) changes. Therefore, Process-Change candidates should be no more than 20% of the list of proposed changes.

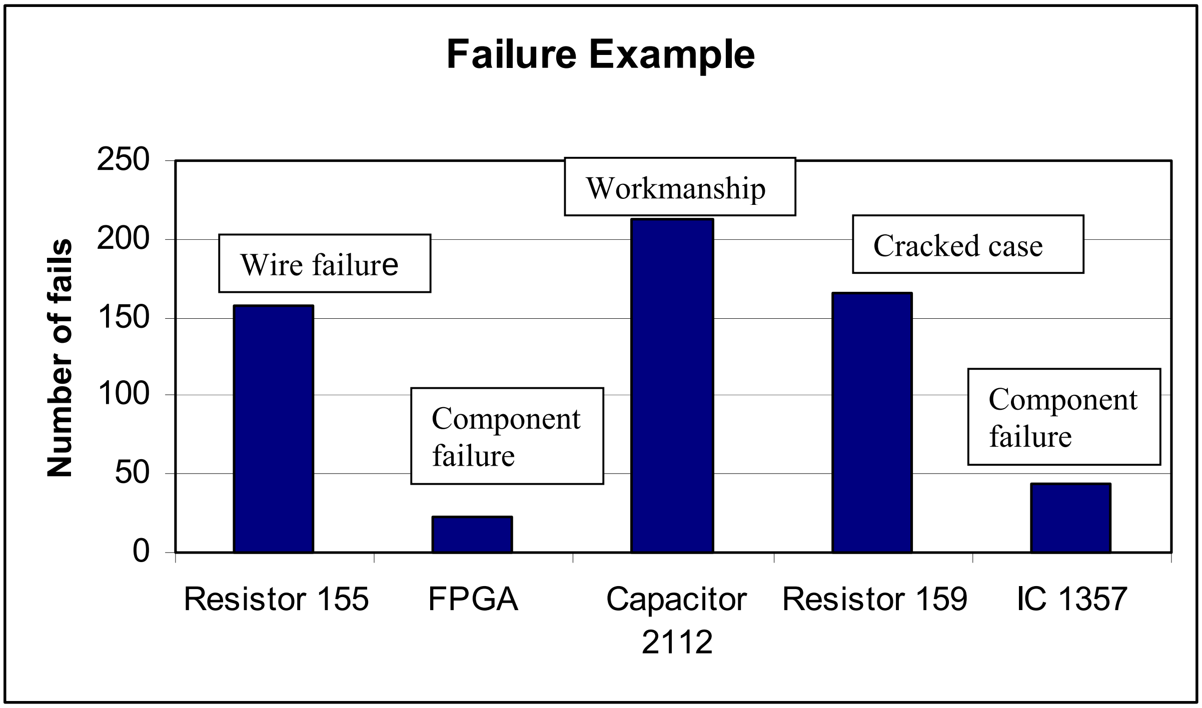


Figure 3-3-1. Failure Data Graph Example

Design-Change candidates are where the biggest and long-lasting reliability improvements will be made [Sharp]. Unfortunately, they are also the most costly, so not all of the obvious design improvements can be implemented. Once the list of Design-Change and Process-Change candidates has been made, the costing process begins.

3.5 Costing, Cost/Benefit Trade Studies and Risk Analysis

Determining the cost to implement each design change and process change is the next step in this methodology. Calculating the cost involves a host of factors: materials, engineering design and evaluation time, failure and redesign time, costs to change drawings, costs to change procedures, cost to change assembly instructions, costs to change tooling and test equipment, training technicians and operators, qualification testing.

Once the cost to implement a change is calculated, a cost/benefit trade study is performed. This trade study should take into account such things as cost savings by passing tests faster, less failure write-ups and reworks anticipated in the factory, and material savings (if any). Some of these factors will have to be estimated. Also, the length of time of anticipated production should be included.

The cost/benefit trade studies will eliminate some candidates. These candidates may be the highest failure items, because they are also the most costly to redesign, and the payback period would be too long.

3.5.1 Reliability Modeling Software Tool

At this stage, a new software tool for Reliability estimating, such as PRISM® , may be introduced if the program doesn't already use one. By using a software tool, tweaking the tool until the results closely match the measured reliability for the current design, and then incorporating proposed design changes, the user can see how much improvement in reliability may be expected. This provides information that is probably more accurate than simple estimation. Also, during the next RQT or RGT, this model can be validated with customer approval, and used in lieu of future RQT or RGTs. This saves several hundred thousand dollars for the US Military and the contractor

3.6 Implementing Cost-Effective Changes

The next step in the Reliability Improvement process is to implement those design changes and process changes that the trade studies showed to be cost effective. For almost any military product, changes of large magnitude require customer approval. For example, small changes, such as a pin-for-pin replacement for Resistor 155 may not need customer approval. Larger changes, such as a relayout of the circuit card to accommodate a replacement for Resistor 155 because there is no pin-for-pin replacement would require customer approval.

More than just redesign of subsystems or processes must occur. Additional items that require consideration at this point in the reliability improvement process are: Design for Reliability, HALT, Process Control, Supplier Control and Configuration Management. After new hardware is built, design verification testing will occur.

3.6.1 Design For Reliability

When design changes are implemented, reliability must be key in the redesign [Al-Khowaiter]. While reliability can never be more important than functionality or cost, it should be third on the list. The purpose of the entire redesign effort is defeated if the new product reliability numbers are equal to or worse than those of the original design. The software tool (Paragraph 3.5.1) is useful in helping determine parts selection in any redesign efforts.

Special care must be taken to minimize new reliability problems being introduced in the new design. A wholesale redesign, especially of mechanical parts, can introduce new reliability problems that have not been anticipated. Integration and validation testing, and HALT help to minimize new reliability problems.

3.6.2 HALT/HASS

If the system has never been subjected to HALT, this point in the redesign process would be a good time for this type of testing. HALT is a test used to find design weaknesses by inducing thermal environments well past specification limits, by inducing vibration environments well past specification limits, then by using rapid thermal cycling to stress components. A final piece of the HALT is a combined environments test where thermal cycling and vibration are used simultaneously to induce failures [Hnatck]. Any induced failures are then analyzed to see if reliability and/or system performance can be improved through redesign of these subsystems or components.

A consideration for HALT on airborne or surface military systems might be to perform the test in a regular thermal combined environments chamber [W. Wang]. Because these systems are usually heavier than a single circuit card, and their environments are more sever than a normal HALT chamber can produce, military systems require a different chamber. The move to a traditional thermal combined environments chamber will cost some slowing of the rapid thermal cycling, but all other HALT portions can be tested as planned.

3.6.3 Process Control

Another area that requires special attention during this phase of the Reliability Improvement methodology is Process Control. As changes are made in some manufacturing processes, the entire manufacturing flow and each individual process should be examined for possible improvements. This may well include Statistical Process Controls (SPC), a technique for monitoring processes such that future “out of control” activities at any statistically controlled process point can be forecast and prevented [Sharp].

A deeper aspect of Process Control is controlling the human element. Instead of removing humans from the manufacturing process, some are embracing a human-centered approach to manufacturing [Greenburg]. In the human-centered approach, the operator remains in control of the process, but is provided additional support that helps the human detect their own mistakes. An error monitor is one form of this human-centered support.

Most manufacturing companies have moved away from 100% Quality Inspections, or inspections of all items at every process step. Companies now allow self-QA. It may be advisable to return to the 100% QI at key points in the manufacturing process as another method to help control the human aspect. Inserting 100% QI at certain strategic process points will improve the human reliability, without appreciably slowing the process or adding the cost of 100% QI for the entire manufacturing process.

3.6.4 Supplier Control

The most frequently overlooked place where reliability must be maintained is supplier control [Billinton]. A conscious effort must be made early in the redesign effort to control parts suppliers. If a parts supplier changes anything that affects reliability, such as packaging or manufacturing processes, this can negatively affect overall system reliability. “This is no guarantee that high quality parts will result in a highly reliable product…but it is certain that low quality parts cannot be made into a reliable product" [DoD2].

Often, especially in larger companies, purchasing is a separate entity, and does not understand how changing parts manufacturers can affect systems. All the purchasing agent sees is cost savings, because the new manufacturer is a quarter-cent cheaper on each resistor, a potential for thousands of dollars saved. The purchasing agent is evaluated on money saved, and usually never hears about problems caused on the manufacturing floor by that manufacturer change.

Supplier control is also a subset of Configuration Control. If the drawing calls for a specific part, that part should be purchased and used in the system.

3.6.5 Configuration Control

Configuration control should not be confused with change management. Configuration control is utilized to prevent unnecessary changes, while change management is used as an administrative function to process drawing changes. Configuration control is employed by describing the desired result, then controlling all changes during the systems redesign and manufacture [Boznak]. Minimizing configuration changes helps to prevent cost overruns, prevent schedule delays and ensure reliability.

Configuration Control also involves ensuring that the correct parts are procured and used in the assembly process. Quality and Reliability engineers, along with Supply Chain managers, must work closely with configuration managers to guarantee that a strong CM process is used.

3.6.6 Design Verification Testing

Once redesigned parts and processes have been implemented, and hardware has been produced, a design verification test is advised. A DVT is a scaled back version of a Full Qualification Test (FQT). The new system design is tested to the specification environmental and performance limits, only on a subset of the FQT. The major tests are run: performance at high and low temperature extremes, vibration and the worst-case shock environments. Since HALT has already been run on this new design, no combined environments testing is required.

If failures occur during DVT that require redesign, then DVT is repeated. This cycle of redesign and retest occurs until a stabile system design passes all tests. Once DVT is passed, a limited production run is made and these systems are subjected to a FQT.

3.7 Qualification Testing

For most military systems, once a major system redesign occurs, a Full Qualification Test (FQT) is required. This includes either RQT or RGT. The scope of the testing after a redesign is usually written into the contract, and is agreed upon with the customer prior to the redesign. The number is systems to be tested is also agreed upon prior to the redesign.

Failures during FQT are recorded, analyzed to root cause, and corrective action is implemented. This failure information becomes part of the failure data base, and are used to estimate System reliability. Once FQT is complete, and all failures have been closed, a new reliability calculation is performed.

3.8 Post-Test Activity

After FQT is passed, production of the new system design ramps up. It is important to continue to collect manufacturing failure data and to keep the failure data base current.

Once all FQT failures have been closed, a new system reliability number is calculated, using only the FQT failure data. However, the method for calculating the system reliability should be the same as that used in Paragraph 3.2. Compare the new system reliability number with the old system reliability number. If the redesign is successful, the new system reliability number is at least 20% larger than the old reliability number. The more redesigns undertaken, the larger that reliability increase should be.

The new reliability number should also be compared with the number supplied by the reliability software tool implemented in Paragraph 3.5.1. If the software tool is used properly, these numbers should correlate closely. This validates the reliability modeling tool, and can save the cost of future RQT or RGT.

3.9 Cost Savings Calculations

As failure data continues to be collected during manufacturing and fielding, it should also be used to calculate cost savings associated with less failures in manufacturing and less fails in the field.

3.9.1 Manufacturing Cost Savings

The cost of a manufacturing failure is estimated at every step in the production process. The cost of manufacturing failures during the 12 months prior to the system redesign are calculated. After 3 months of producing the new system design, the cost of manufacturing failures during that 3 months is calculated. This cost is compared with the cost during the last 12 months of manufacturing the old design. If the reliability improvement process was successful, the cost should be lower by approximately the same percentage as the improvement in reliability. This is because, if reliability has improved by X%, then failures during the manufacturing process have dropped by approximately that amount. The cost saved on the troubleshooting, rework and retest during the manufacturing process should have dropped by approximately that same percentage.

3.9.2 Warranty Cost Savings

If the system is under a warranty, the cost savings on warranty work is also calculated. This cost savings will not be as large as the cost savings seen in manufacturing because units with the old system design are still failing in the field. The only units in the manufacturing area are of the new design. If the reliability improvement is successful, the cost savings seen from warranty work should be approximately

$$\text{Warranty Cost Savings (\%)} = \text{RI(\%)} \times N / T$$

Where: RI = Reliability Improvement as a percentage

N = Number of New Design Systems in Field

T = Total Number of Systems in Field

As old design systems fail and are fixed, they should be upgraded to the new design to the extent economically feasible. As the number of new design systems becomes a larger percentage of the total systems in the field, the warranty cost savings will increase.

The cost of shipping failed systems from the field back to the manufacturer is known. The cost at each step of troubleshooting, rework and retest is taken from the manufacturing cost estimates in Paragraph 3.9.1. The cost of shipping from the manufacturer back to the field is known. After 12 months of fielding the new system design, calculate the cost of failures during the last 12 months. The 12-month window is chosen to allow time for the new system design to be more widely used in the field, and to fail in the field. Calculations for any shorter timeframe would really be based only on failed old design systems.

3.9.3 Test Failure Cost Savings

In most military programs, another qualification test is required by contract at the 2-year mark in production. This test is performed to ensure that any minor changes in manufacturing parts or processes during the 2 years since the last test have not degraded system performance. The test failure cost savings are calculated by taking the number of test failures and multiplying them by the correct manufacturing costs of troubleshooting, rework and repair estimates from Paragraph 3.9.1. The test failure cost savings are compared to the last Old System Design test of similar scope. The percentage of test failure cost savings should be approximately the Reliability Improvement percentage.

At this point in the contract, the total cost savings is equal to the sum of the Manufacturing Cost savings, Warranty Cost savings and Test Failure Cost savings. The redesign payback period is that time when the cost of redesign equals the total cost savings.

3.10 Continuous Improvement

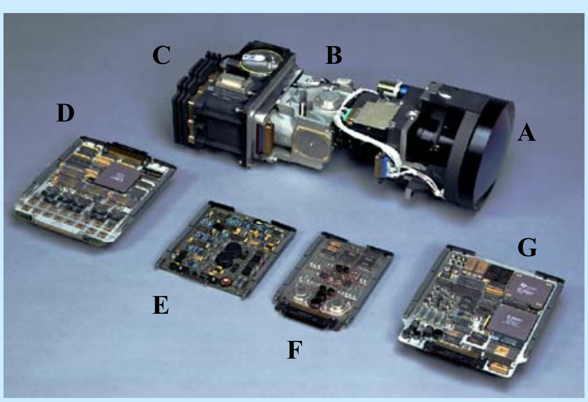
Continuous product improvement occurs by continuing to collect and analyze Manufacturing, Test and Field failure data, and to implement corrective actions as failure trends emerge. Constant attention to Process Control and Supplier Control will also help in the continuous improvement of the system.

PART B   USE OF THE METHODOLOGY FOR RELIABILITY IMPROVEMENT ON NV-80 B-KIT FLIR

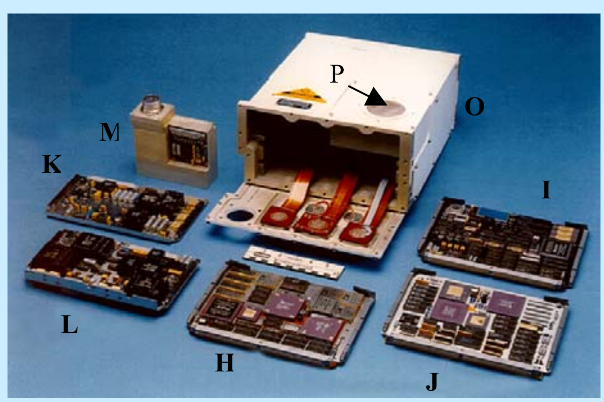
Chapter 4
Introduction to the NV-80 B-Kit

The NV-80 B-Kit, contracted by the US Army through PM FLIR and PM Night Vision (NV), is a Forward Looking Infrared (FLIR) scanning receiver that collects radiation in the 8-12 micron spectral region across two different two-dimensional fields of view (FOVs) using a second generation IR focal plane array. This system performs a variety of signal and image processing and outputs electronic video signals. The NV-80 B-Kit is composed of a Sight Unit (SU) and the Second Generation Electronics Unit (SGCEU). Both the SU and SGCEU consist of several modules, each having pre-defined interfaces and physical connections, defined in the Interface Control Document (ICD), that allow the NV-80 B-Kit to function as a stand-alone unit that requires only an external power supply, fixturing, card cage with interconnect, control interface and cabling in order to operate.

By U.S. Army terminology, a B-Kit goes into an A-Kit and then a C-Kit or I-Kit is used to install the A-Kit onto an End Item, such as a plane or tank. In other words, this B-Kit is the electronic innards of several different U.S. Army A-Kits. It may soon be used by the Marines too.



Sensor Unit



Second Generation Electronics Unit

Figure 4-1-1. The NV-80 B-Kit

The NV-80 B-Kit consists of individual assemblies listed below:

Table 4-1-1. B-Kit Assemblies List

Sensor Unit (SU) Assemblies	
Assembly Name	**Letter in Figure 4-1-1**
Afocal Assembly	A
Imager Bench Assembly	B
Detector/Cooler Bench Assembly	C
Receiver	B & C bolted together
Digitizer CCA	D
Cooler Control CCA	E
Point of Load Regulator CCA	F
Scan Control CCA	G
Second Generation Common Electronics Unit (SGCEU) Assemblies	
Assembly Name	**Letter in Figure**
Video Processor CCA	H
Interface Control CCA	I
CE/FI Jumper CCA	Not Shown
Video Converter CCA	J
Power Supply 1 CCA	K
Power Supply 2 CCA	L
EMI Filter	M
B-Kit Spare/Growth CCA	Not Shown
EU Housing, motherboard & interconnect	O
SGCEU fan	P

An additional quirk for the B-Kit is that two companies manufacture pieces, then each company ships its parts to the other company to make a B-Kit. Raytheon manufactures the Receiver, Scan Control CCA, Digitizer CCA, Cooler Control CCA in the SU and the Video Processor CCA in the SGCEU. Another company mnufactures the Afocal and POL in the SU, and the SGCEU, including the Interface Control CCA, the Video Converter CCA and the Power Supply CCAs and motherboard inside the SGCEU.

The situation that resulted in the writing of this Master's Report was a new contract where Raytheon will manufacture the entire B-Kit, as will the other company. This contract also contains a requirement where the NV-80 B-Kit Reliabilty was increased from an MTBF of 850 hours to an MTBF of 1000 hours. This paper is documentation of the process derived and used in the attempt to meet that new Reliability requirement.

4.1 B-Kit Failure Data

Failure data for the B-Kit was captured in different systematic fashions over the 9-year life of the program. The first 3 years of program life were design work, so were no failures to capture. Once hardware was built, failures were captured on hand-written sheets, and signed off when the corrective action had been taken. Electronic capture of failures began in 1998, using FRACAS.

4.1.1 B-Kit Test Failure Data

Test failures thoughout the 8-year B-Kit program have been carefully recorded, analyzed for root cause, and corrective actions have been implemented in most cases.

4.1.1.1 B-Kit Testing History

The B-Kit has been through seven Qualification tests in the 9-year life of the program, and has just started its eighth Qualification test. Table 4-1-2 shows each test name and date of test report.

The normal timeframe for qualification testing of military hardware is every 2 years. However, when significant changes are made to the hardware, it must go through a requalification. The B-Kit was subjected to 2 qualification-type tests in the Engineering, Manufacturing and Development (EMD) phase of the project. The EMD Qualification Test [Ray9] was abbreviated to meet the customer's budget constraints, but did include a 2000-hour RGT [Ray2]. A second test, the EMD Closure Test [Ray4], was run to ensure that the B-Kit could meet all Performance Specification Requirements that had been cut from the EMD Qualification test. During these tests, all failures were recorded on Reliability Failure Records (RFRs).

Table 4-1-2. B-Kit Testing History

Qualification Test Name	Test Report Date
EMD Qualification Test	May 27, 1997
2000-hr RGT	May 5, 1997
EMD Closure Test	Dec 8, 1997
LRIP Qualification Test	Feb 6, 1999
2000-hr RGT	Sept 10, 1999
Andover Mini-Qual	Feb 17, 2000
McKinney Mini-Qual	Mar 10, 2000
SMT Qualification Test	Aug, 2001(test date)
Source Development Qualification Test	Aug, 2002

2000-hr RGT	May, 2002
OMNI Qualification Test	In-progress
RGT to show 1000-hr MTBF	In-progress

During the Low Rate Initial Production (LRIP) phase of the project, the B-Kit was subjected to the LRIP Qualification Test [Ray7]. This test included a 2000-hour RGT [Ray6]. During LRIP, the manufacture of CCAs was moved from the Lewisville, TX Raytheon facility to the Andover, MA Raytheon facility. This was deemed a significant change to the B-Kit, so a scaled-down version of the qualification test, the Andover Mini-Qual [Ray1], was performed. A decision was then made to split production of CCAs between the Andover, MA Raytheon facility and the McKinney, TX facility. Another scaled-down version of the qualification test, the McKinney Mini-Qual [Ray8], was performed. As technology obsolescence caught up with the B-Kit CCAs, the cards were redesigned from through-hole technology (THT) to Surface Mount Technology (SMT). The SMT Qualification Test [Ray11] was performed on the new design. This test did not include any formal reliability testing. The Source Development Qualification Test [Ray12] was run when the customer decided to grow competing sources to build the B-Kit. This is the first time that Raytheon has built all the assemblies for the B-Kit. This qualification test included a 2000-hour RGT [Ray10]. During all of the above testing, failures were recorded on the Failure Incident Analysis Reporting (FIAR) system.

4.1.2 B-Kit Manufacturing Failure Data

The collection of manufacturing failure data started out on hand-written trouble sheets on the back of the Shop Router. Failures were closed via a sign-off of the trouble sheet so that the system could be sold. These trouble sheets were copied and shipped with each system, thus the customer had a history of system failures during the manufacturing process. In 1998, the factory switched to the FRACAS system, and failures were captured in an electronic database. The electronic database will be used for this example.

On the HTI project, the B-Kit manufacturing failure data are used to show: 1) Statistical Process Control, 2) First Pass Yields in major process areas, 3) parts problems and 4) Individual technician or operator first pass yields. These items are scrutinized to determine which processes can be improved, which subsystems may be too difficult to assemble as designed, and which technicians and operators need more training. A monthly Failure Review Board is held to analyze factory failures and view manufacturing failure trends.

4.1.3 Field Failure Data

The NV-80 B-Kit has a two-year warranty against all failures systemic to the B-Kit. Failures caused by environments outside the Performance Specification limits, by A-Kit induced electrical problems, or by user mishandling are not covered. An examples of a covered failure is a temperature induced failure that occurred while using the B-Kit at the Yuma, AZ proving grounds on a hot day. This temperature environment is within the Performance Specification limits. An example of a failure not covered under warranty is damage done when a HUMMWV rolled on an A-Kit, crushing the A-kit case and parts of the B-Kit within. This environment is not covered by the Performance Specification [DoD4]. While the B-Kit assemblies that were damaged were shipped back for repair, the repair was paid for by other means. It is not at all unusual to get out-of-warranty damaged assemblies returned, with a customer request for a repair quote. The serves three purposes: it usually results in the B-Kit being repaired, it allows the design engineers, technicians and operators to see the results of some unusual circumstances to which the system is subjected, and it give the design engineers fresh ideas for B-Kit robustness enhancements.

Initial field failure and warranty data were collected using a simple EXCEL spreadsheet. As more systems were fielded, this became overwhelming. In 2000, the field failures began being electronically tracked using FRACAS. The field failures in FRACAS are the ones that are used in this example.

4.1.4 User Feedback

Over the 8-year program history, user feedback has been valuable in pointing out areas where the B-Kit needs improvement from the user's point of view. One example of user feedback was that the SGCEU fan was always becoming blocked, thus slowed or stopped operating. This caused the maintenance crews to instigate a preventative maintenance program so that every 3 months, the fans were inspected and cleaned. The fan blockage from debris collecting on the fan cover did not cause fan failures, simply cause the fan to not work as efficiently. Thus, the design engineers never saw a failed SGCEU caused by fan blockage, warranty repairs were never performed, but it was something that the customer needed changed.

There have been multiple items that have been changed as a result of customer feedback, either A-Kit customers or the U.S. Army customers.

4.2 B-Kit Current Reliability Calculation

At the end of the Source Development Qualification Reliability Growth Test, the B-Kit reliability was calculated as 530 hours MTBMAF (Mean Time Between Mission Affecting Failures). This excluded SADA failures. If SADA failures were included, the B-Kit MTBMAF was calculated to be 461 hours. The specification is 850 hours. The need for reliability improvement has been recognized and quantified. The reliability was calculated using the AMPSAA reliability growth model [DoD1]. Table 4-1-1 lists the B-Kit Mission Affecting Failures included in the reliability calculations.

Table 4-4-1. B-Kit Mission Affecting Failures from Recent RGT

Failed Part	Number of Mission-Affecting Failures
SADA II	2
Video Converter CCA (caused secondary Afocal fail)	1
Filter Wheel Potentiometer	1
Total	4

These 4 failed items automatically became the top 4 on the list of design-change candidates. Other candidates were determined by looking at all failures throughout testing.

For this example, the author used all test data, not just the last RGT, to calculate an point source instantaneous MTBF of 61.378 hours. This iMTBF is the 'brute force' approach, in that it does not disregard failures as Non-relevant or Non-Mission-Affecting. Any test failure that was not caused by operator error or test fixturing/computer error was counted in this calculation. This calculation also included fails from all Source Development Qualification tests. The detailed failure calculations are shown in Appendix A, B-Kit Current Reliability Calculations.

4.3 B-Kit Trend Analysis

4.3.1 B-Kit Test Failures

The B-Kit failure data was looked at in many ways. The first 'slice and dice' was looking at test data only. Figure 4-3-1 is a pie chart showing what percentage of all test failures were workmanship failures and what percentage were design flaws that resulted in failure.

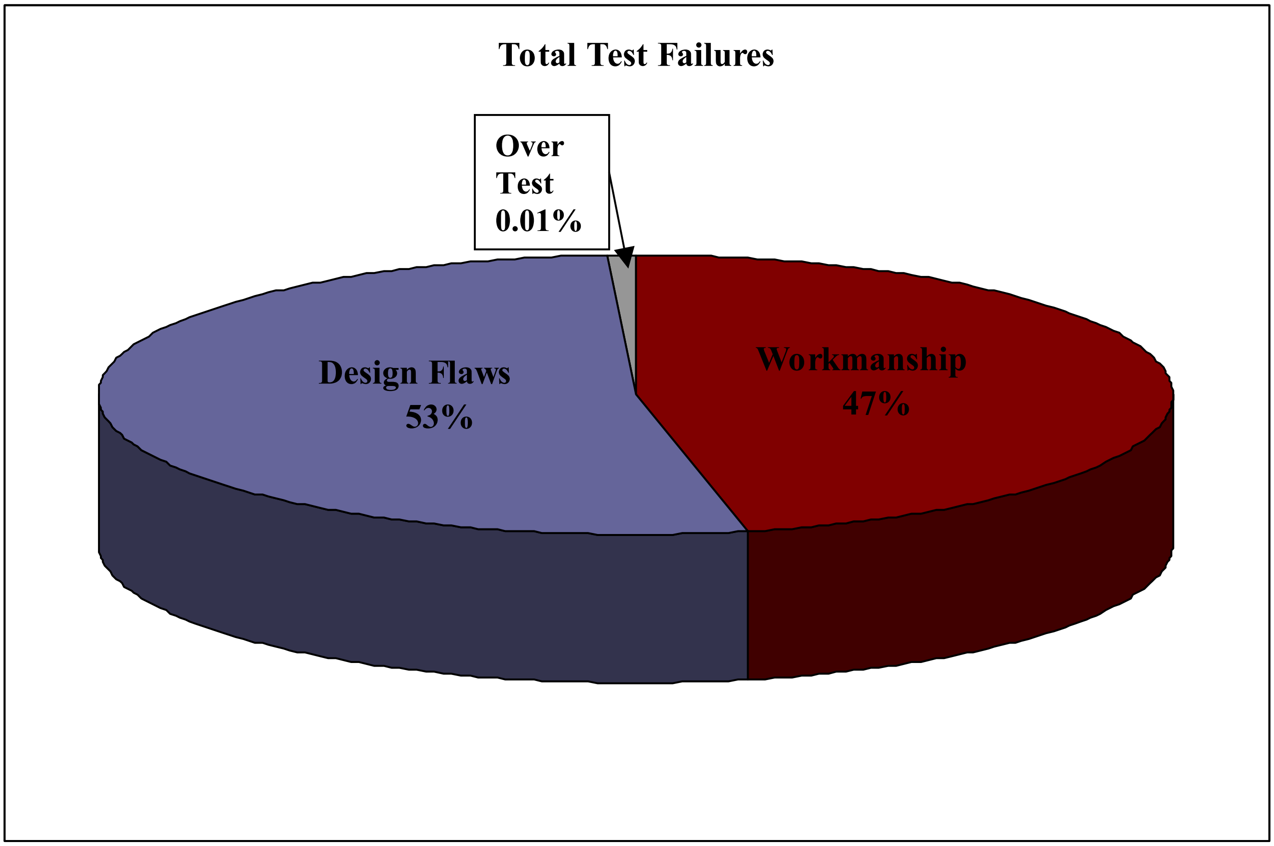


Figure 4-3-1. Total Test Failure Distribution, D or W

This figure shows that Design flaws made up 53% of the test failures and Workmanship errors made up 47% of the total test failures. This might mean that the manufacturing processes should be examined for areas where processes can be improved, or for processes where the design is too complicated and should be simplifed. Another explanation might be that there is too much throughput in the manufacturing process for the operators and technicians to be able to do quality assembly work.

A second ‘slice’ of the test failure data is shown in Figure 4-3-2. This figure shows the test failures by B-Kit Assembly.

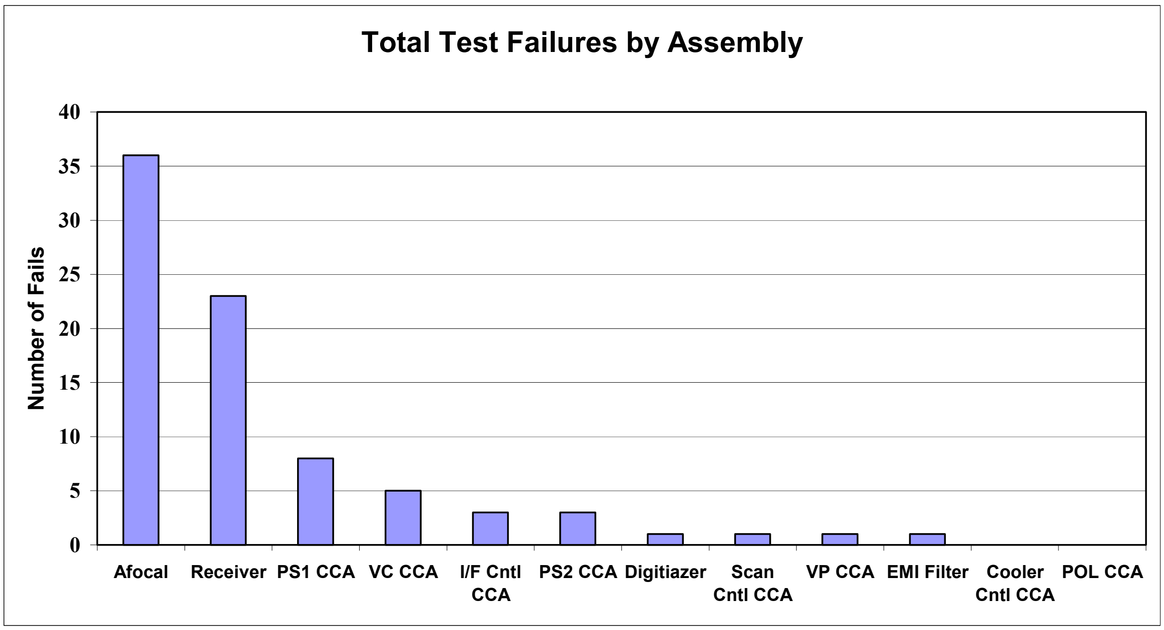


Figure 4-3-2. Total Test Failures by B-Kit Assembly

This figure shows that, by a large margin, the two B-Kit assemblies that may yield the largest reliability increases through redesign are the Afocal (36 failures) and the Receiver (23 failures). Since these two assemblies contain most of the mechanical parts of the B-Kit, it is not unexpected for them to have the largest number of failures. The SGCEU fan is the only other mechanical part on the B-Kit. The other interesting feature of Figure 4-3-2 is that the Cooler Control CCA and the POL CCA have caused Zero failures.

Since the Afocal and Receiver are made up of subassemblies, the next 'slice' will be to examine the Afocal subassemblies to pinpoint exact problems. This 'slice' is shown in Figure 4-3-3.

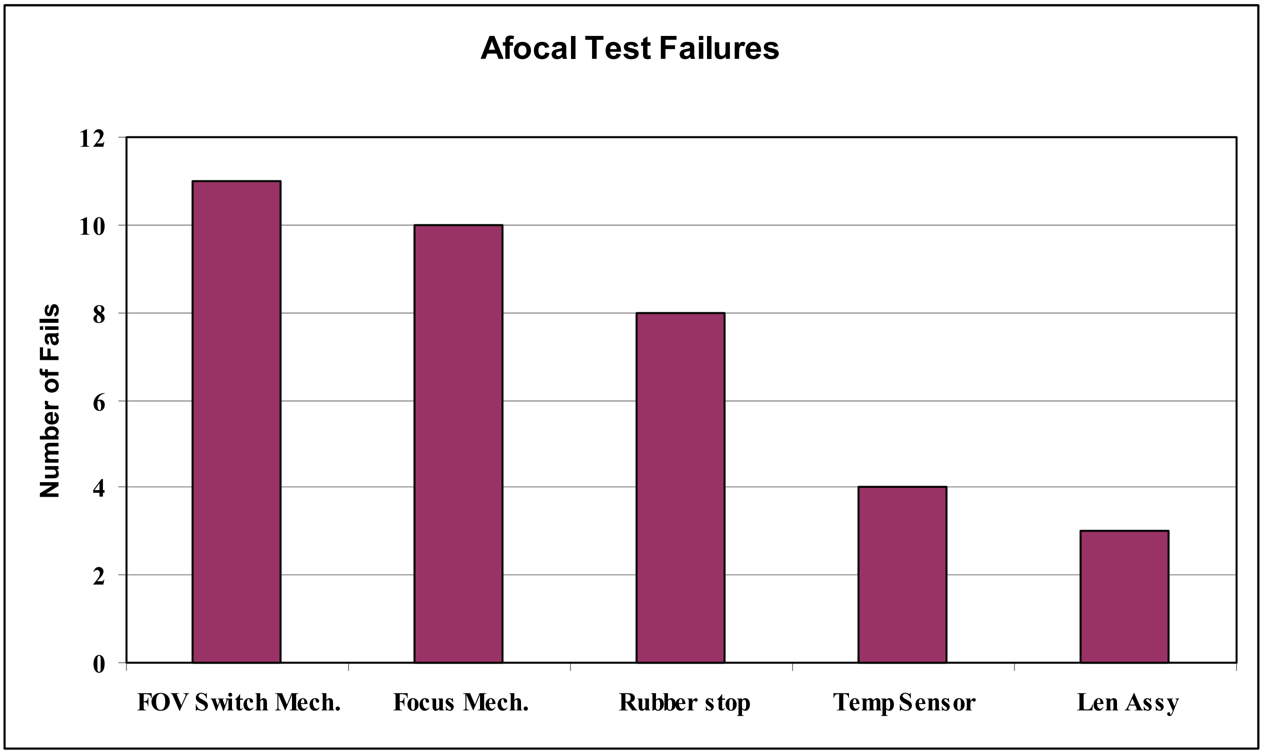


Figure 4-3-3. Afocal Test Failures by Subassembly

This figure shows that the FOV switch mechanism is the largest contributor to the Afocal failures in test, followed closely by the Focus mechanism. The third largest cause of Afocal failures in test is the Rubber stop.

This figure illustrates a weakness in examining all test data over the life of the system. The rubber stop was redeisgned in 1999. The failures shown here all occurred prior to the redesign, none have been seen since the new rubber stop began use. Therefore, the rubber stop is no longer a valid design-change candidate, despite what the figure shows. Care must be exercised in using data collected over a 9-year time period.

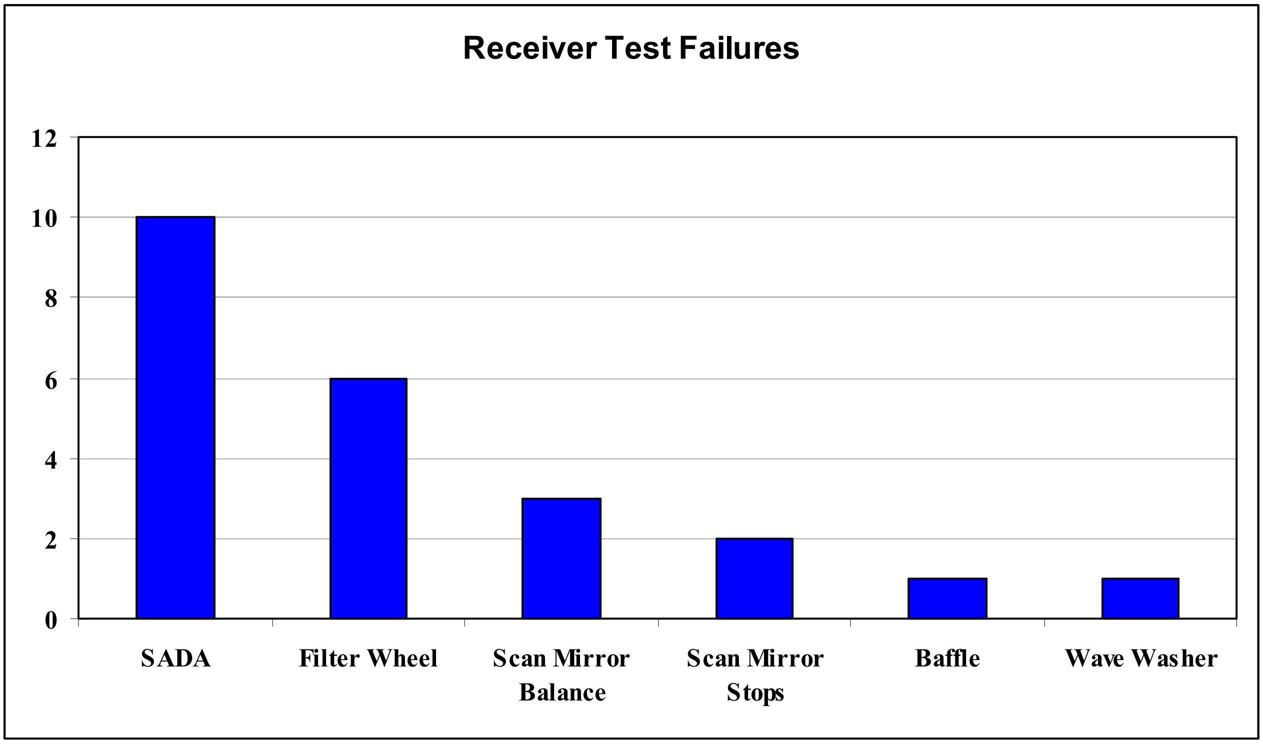


Figure 4-3-4. Receiver Test Failures by Subassembly

Figure 4-3-4 shows the 'slice' of Receiver subassemblies. This figure shows the largest cause of Receiver fails during test is the Standard Advanced Dewar Assembly, Type II (SADA II). Unfortunatly, this subassembly is Government Furnished Equipment (GFE) to the system, so no redesign or control of reliability is within our power. The second largest contributor to Receiver test failures is the Filter Wheel subassembly.

One more way to 'slice' the test failure data is to look at corrective actions and see how many corrective actions didn't work effectively. If a test failure was seen in later Qualification testing or in manufacturing after a corrective action was taken, then the corrective action was not sufficient to alleviate the failure. These are shown in Figure 4-3-5.

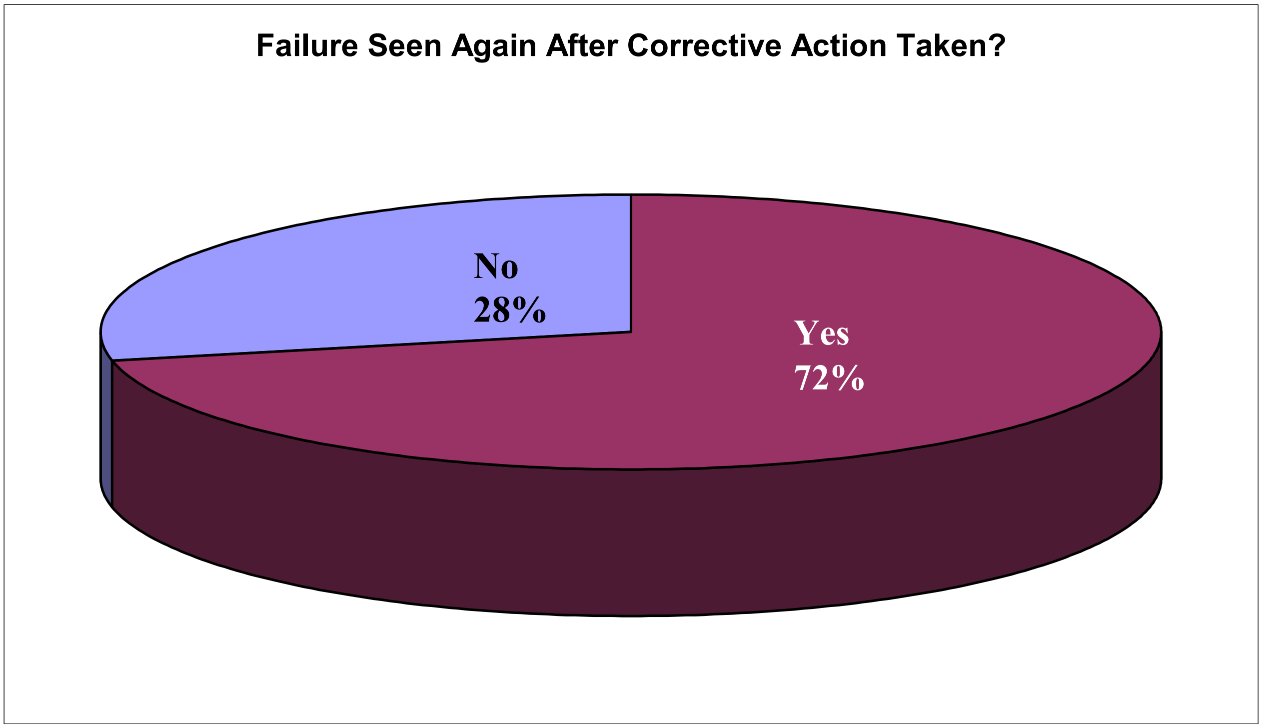


Figure 4-3-5. Test Failures and Proper Corrective Action

This figure shows that corrective actions was not effective in preventing the problem from recurring. From a systems engineering and design engineering perspective this is the most troubling of the ‘slices’. Corrective action was taken in the case of almost all of the failures. The only exceptions were those, like the SADA, where the corrective action was out of our control. The other failures that fall into this category are: Failure of Athermalization, Failure of Audible Noise on both the Afocal and the Filter Wheel assembly, failure of FOV at temperature, and the o-ring material. Of the 72% where the failure was seen again, one-third were design flaws. The remaining two-thirds were workmanship errors. This means that the corrective action, whether it was revision of assembly instructions, operator training, or color-coding of wires, did not alleviate the workmanship issue.

Of the one-third that were design flaws, two facts are evident as to why the corrective action was not effective. First, the true root cause was not identified. The failure sysmptoms were corrected, not the root cause. Second, the Integration, Validation and Verification (IV & V) of the design fix was not performed correctly. The repitition of failure should have been caught in the IV&V, and further failure investigation into root cause was needed at that time. The lack of success at root cause determination and IV & V were caused by a number of things, primarily schedule pressures. The pressure to conclude test by a certain date so that production could begin or resume precluded full investigation and a thorough IV & V process.

All of the 'slices' of B-Kit test data are shown in Appendix B, Analysis of B-Kit Test Failure Data.

4.3.2 B-Kit Manufacturing Failures

The B-Kit Manufacturing failures data and 'slices' are shown in Appendix C. The database is huge and covers the time period from August, 1998 to August 1, 2002. These data is 'sliced and diced' in many different ways to get a true picture of failures during the manufacturing process. These data must be used carefully in correlating manufacutring problems with reliability problems, because this is the only data set that includes 'infant mortality' of piece parts, this is where all workmanship errors should be found, and this is where many 'human' error occur. In a perfect world, these problems should all be corrected before the B-Kit passed Acceptance Test (AT), and is sold. As is seen by the similarities between the testing failures, manufacturing failures and field failures, this is not a perfect world. The failure trends are very similar for all three sets of data.

The manufacturing failure database is huge, a total of 2862 enties. Those entries for 'Operator Error' and 'Test Equipment Failure' were deleted from the database for this report. The data were looked at in many ways, from total number of failures perspective to failures of a particular resistor that is used in several assemblies of the B-Kit. An example of one 'slice and dice' is shown in Figure 4-3-6. This shows the B-Kit manufucturing failures in total. It is not sorted by time period or by manufacturing operation, such as Unit test. It covers a sample of failures from 8/98 to 8/02.

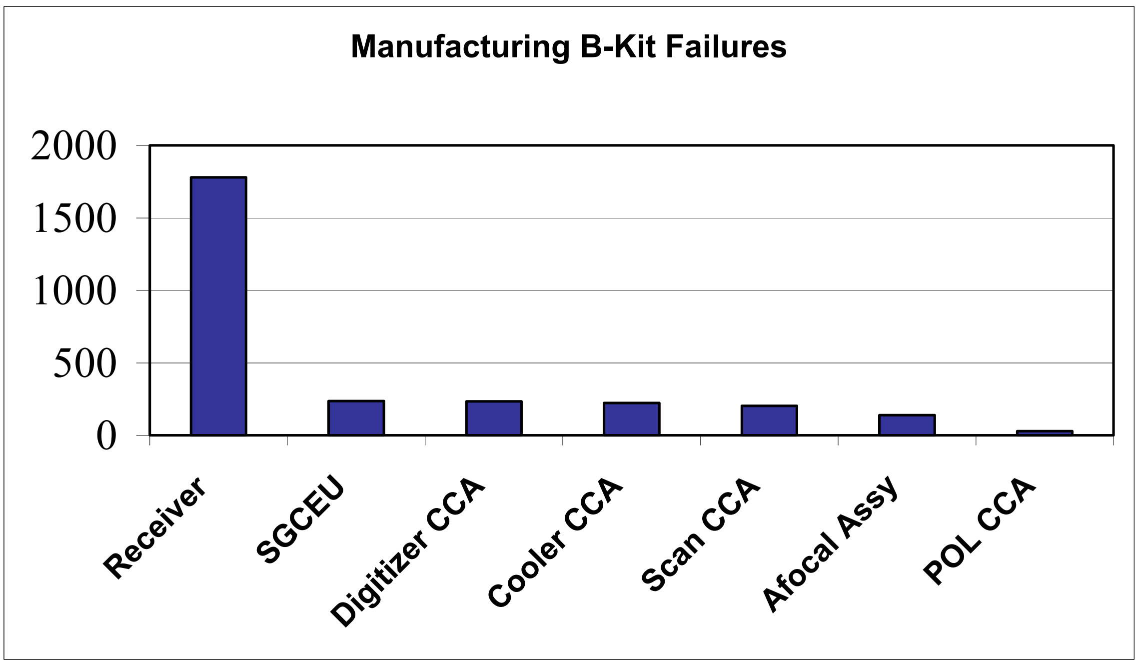


Figure 4-3-6. B-Kit Failures During the Manufacturing Process

The Receiver is the highest failure rate item, by a large margin. Next is the SGCEU, but the next items all have roughly the same failure rate. To date, Raytheon manufactures only the Receiver, Digitizer CCA, Scan CCA and Cooler CCA. The SGCEU, Afocal Assy and POL CCA are manufactured by another company, and sent for use as GFE. These items were supposed to have passed a thorough burn-in process and Acceptance Test before arriving at Raytheon.

The next cut at this ‘slice’ is to plot what parts of the Receiver are failing. This is shown in Figure 4-3-7.

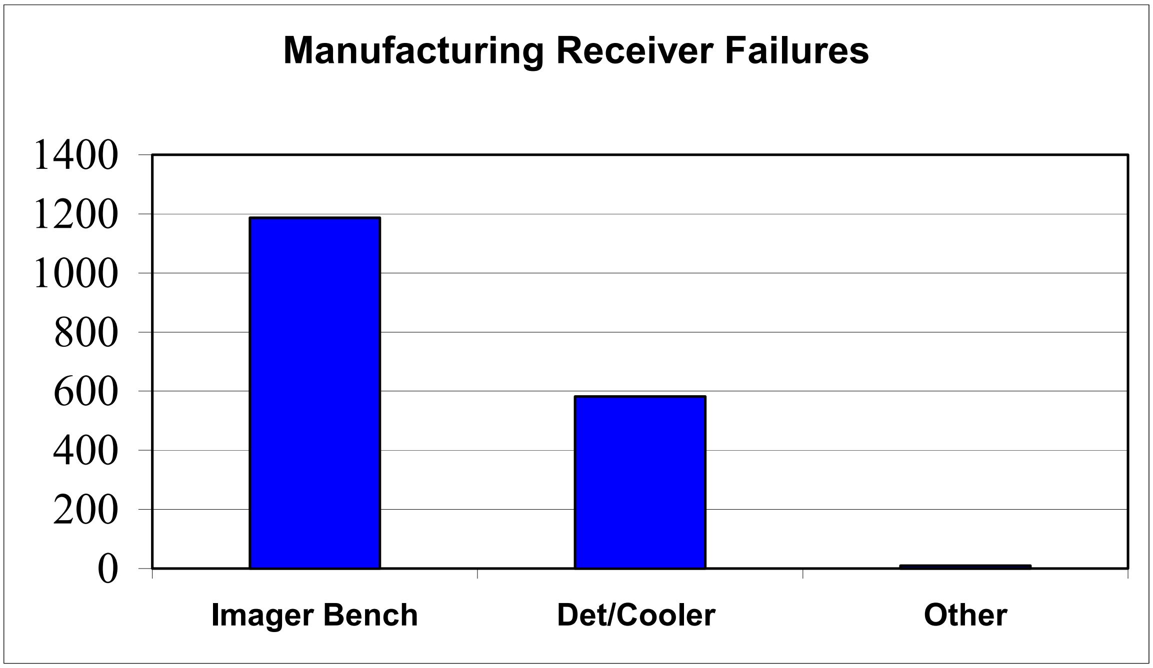


Figure 4-3-7. Receiver Failures During the Manufacturing Process

This figure shows the Imager Bench Assembly and the Detector/Cooler Bench Assembly are the problems in the overall percentage of failures (67% and 33%, respectively). This leads to the next cut—what parts of the Imager Bench Assembly are failing. This is shown in Figure 4-3-8.

This figure shows that the Scan Motor is the highest failure rate item, with the Resolver second, and the Sensor Scan Position third. Again, this shows one of the pitfalls of using a FRACAS that shows data over the long life of the program. A problem with the scanner being slightly off balance caused failures when the B-Kit was operated in the CIV and TIS modes because these modes instruct the scanner to scan in the opposite direction from the B-Kit. Until this interface problem between the Receiver and the SGCEU was tracked down, many Receivers were failed, and the problem could not be duplicated. Raytheon was testing the receivers in the

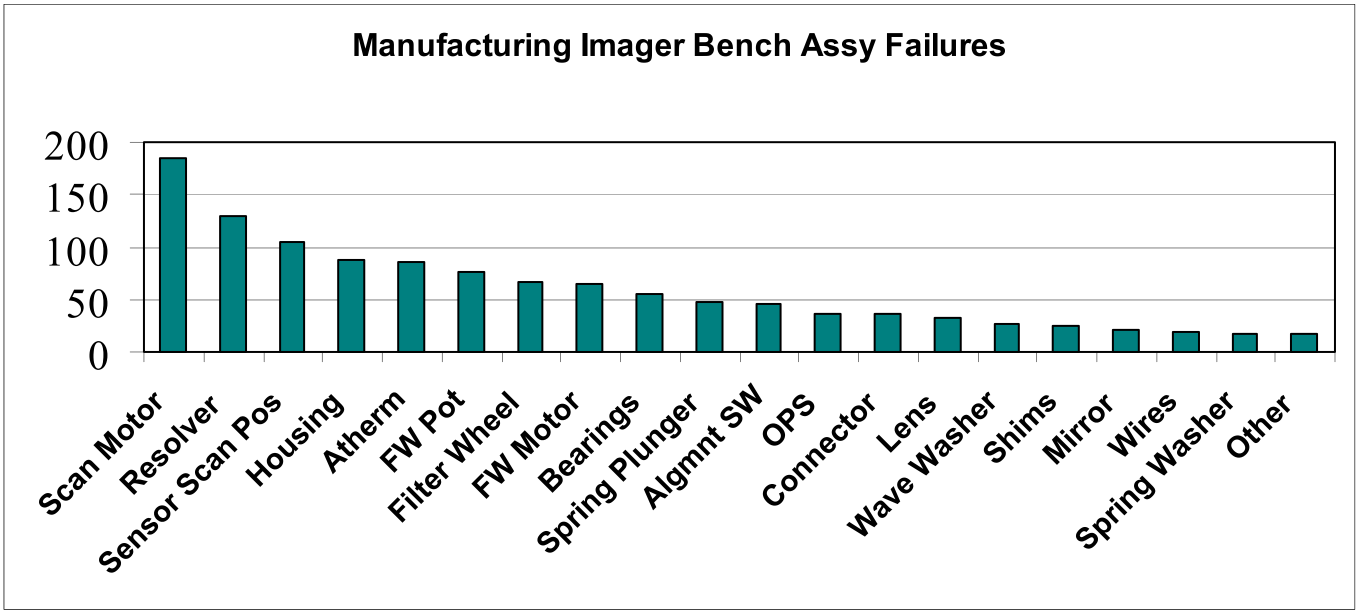


Figure 4-3-8. Imager Bench Assembly Failures During the Manufacturing Process

B-Kits mode, and the scanners were working fine. This problem was corrected almost 3 years ago, so a large portion of the Sensor Scan Position failures had been corrected prior to the last Reliability Growth test. A scan motor did fail during the last Qualification test, so scan motors are still a problem. A new motor is being sought that can handle the speeds required, but that can tolerate the arc motion generated by the scan mirror. The mirror traces an arc instead of a full circular motion that most motors are designed to handle.

From Figure 4-3-7, the second highest failure rate item in the receiver was the Detector/Cooler Bench Assembly. A further breakdown of the Detective/Cooler Bench fails is shown in Figure 4-3-9. This shows that the SADA II is the largest failure item in the bench.

Since the SADA II is made up of two major components, the Dewar and the Cooler, one more cut is needed to understand the failures. This is shown in Figure 4-3-10.

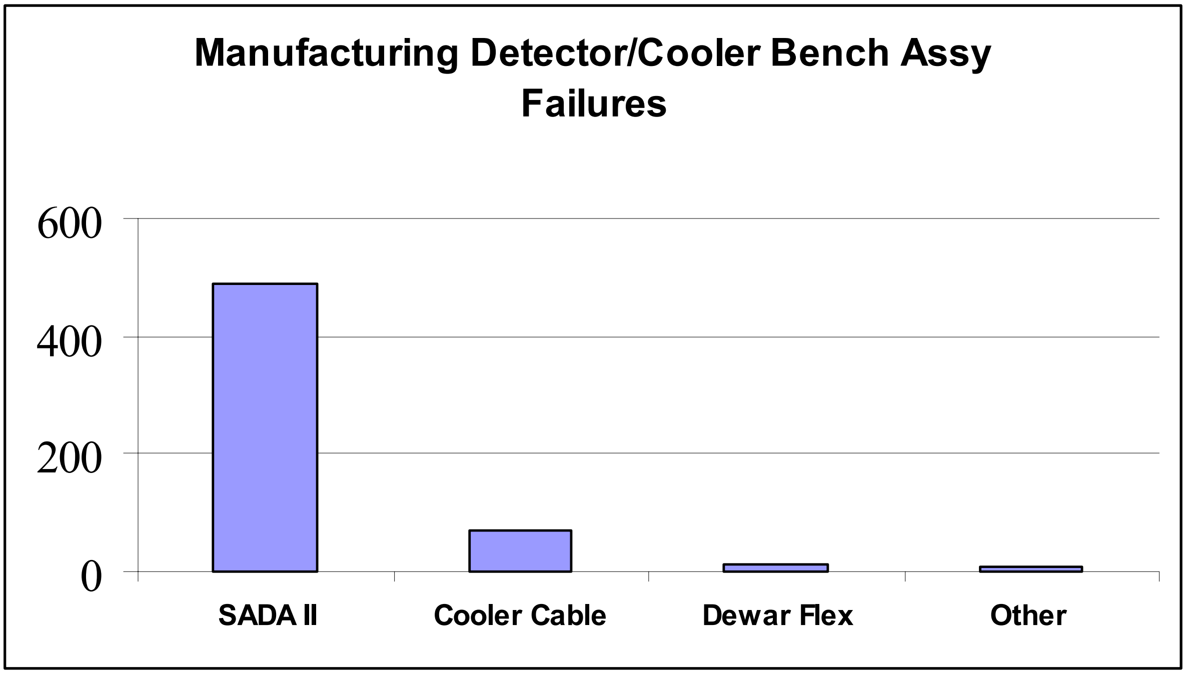


Figure 4-3-9. Detector/Cooler Bench Assembly Failures During the Manufacturing Process

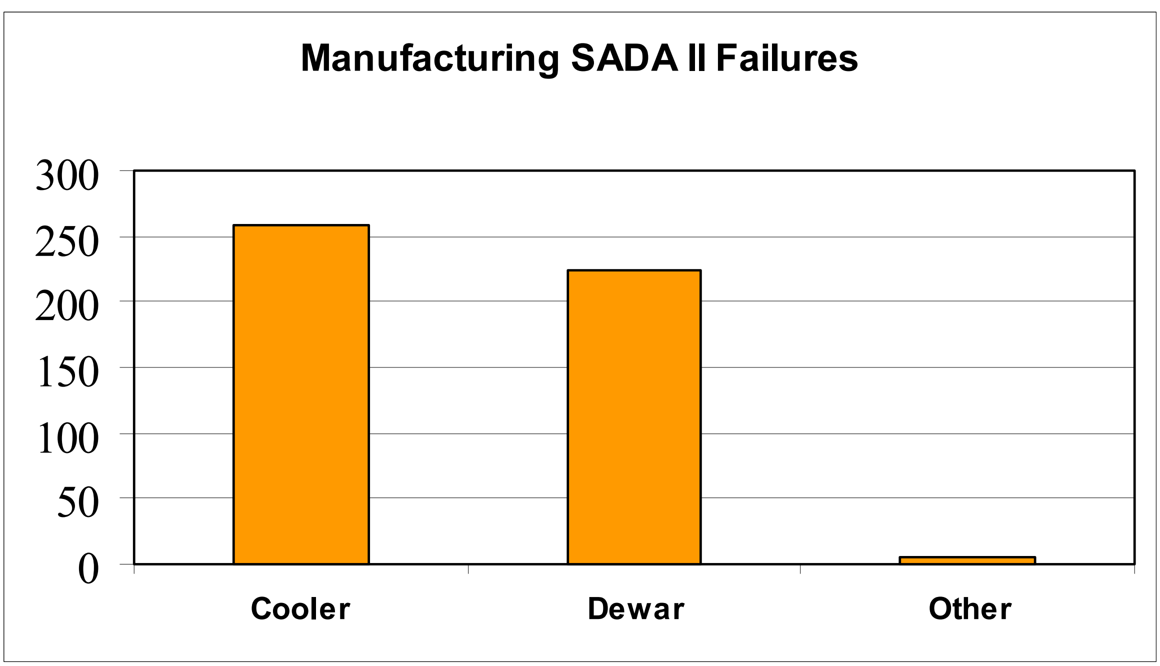


Figure 4-3-10. SADA II Assembly Failures During the Manufacturing Process

The SADA II Cooler causes the greater number of failures during the manufacturing process, but the Dewar is a close second. HTI also goes through a prescreening process to weed out problem SADAs before they are installed in a Detector/Cooler Bench assembly. The current prescreening process for SADAs catches about 2% of the problem SADAs. The rest make it into the B-Kit and are found at various stages in the manufacturing process.

Since the SADAs are GFE to Raytheon, there is nothing that the NV-80 B-Kit program personnel in McKinney can do to affect the reliability of this item. The SADA specification states that the SADA has an MTBF of 2000 hours. During Raytheon reliability testing, this number was shown to be approximately 400 hours [Ray10, p.6]. Until this number is improved, Raytheon faces a significant challenge to meet an MTBF of 1000 hours.

One way around this problem is to set an MTBF without the SADA II. Raytheon and PM FLIR set an MTBF of 1200 hours, not including the SADA II.

Referring back to Figure 4-3-6, the B-Kit manufacturing failures, the second highest failure rate item was the SGCEU. A second cut shows which items in the SGCEU are failing. These are shown in Figure 4-3-11. This shows the Video Processor CCA to be the highest failure rates item. This may be because Raytheon manufactures the Video Processor CCA, while another company manufactures the SGCEU. Raytheon sends the Video Processor CCA as GFE to this other company. The SGCEU may have other failures that are not included in this database because the entire SGCEU is returned to the other vendor for repair.

The manufacturing failures database should be used for other ‘slice and dice’ looks at the reliability problems. This is being done outside the scope of this report. ‘Slices’ for the last year, the last 6 months, each manufacturing operation, each operator and time correlation with problems at other facilities are all being reviewed.

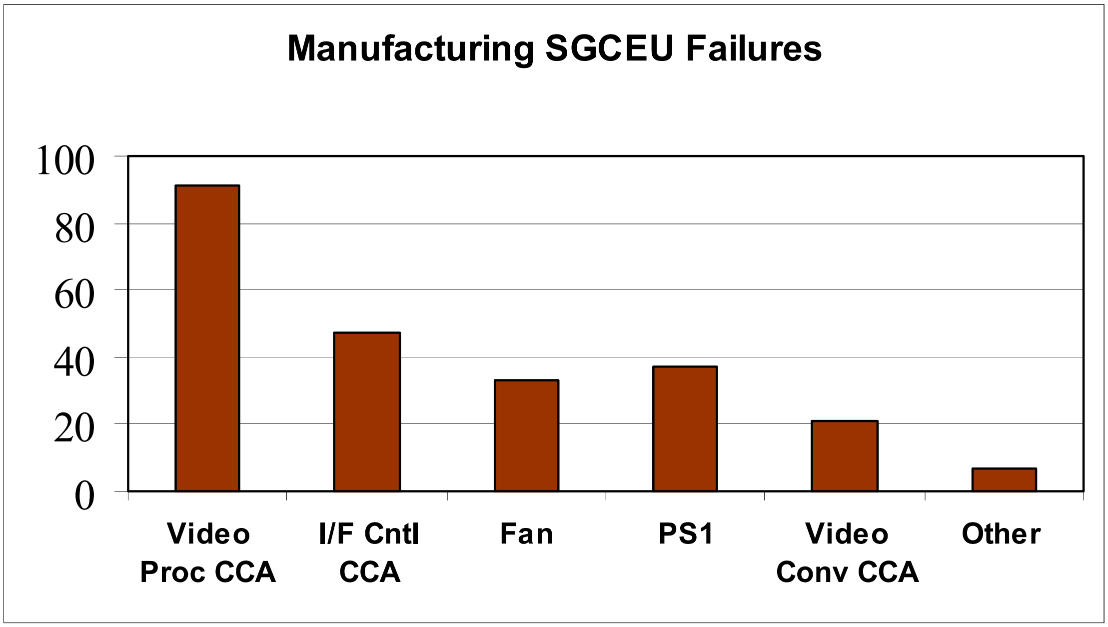


Figure 4-3-11. SGCEU Assembly Failures During the Manufacturing Process

4.3.3 B-Kit Field Failure Data

The field failure data is the hardest to acquire, but the most important in terms of reliability. Raytheon has a warranty on the B-Kit, so all failures of B-Kit parts that Raytheon manufactures are returned to Raytheon for repair. However, the failed B-Kit parts that Raytheon does not manufacture are sent back to the other company for repair. This creates some difficulty in accurately assessing the total scope of the field failures.

Also inherent in any field failure database is a scarcity of information on how the failure occurred (circumstances, environment, activities being performed, etc). In the event of a failure during battle, soldiers are busy doing more important things than filling out failure forms. Some engineering judgement must be applied when viewing reports from this database as to actual failure environments.

The full set of failure data plots and the failure list are found in Appendix D. The field failures database covers the timeframe of December 1999 to August 1, 2002. The entire set of data were used in this analysis, a total of 673 data entries. This represents an overall failure rate of 6.65% (673 of the 10,220 parts in the field). This is lower than the estimated 10% failure rate that was used in the early years of the B-Kit program.

One example of the 'slice and dice' for the field failures of the B-Kit is to look at the entire database, without any filtering. Figure 4-3-12 shows the B-Kit field failures. This figure shows that the Receiver is the highest failed item, just as it was in the manufacturing failure data. The Afocal failures are not handled by Raytheon, so they could be the highest failure rate item for the B-Kit, as is shown in the B-Kit test failures (Figure 4-3-2), but that is not part of the Raytheon database.

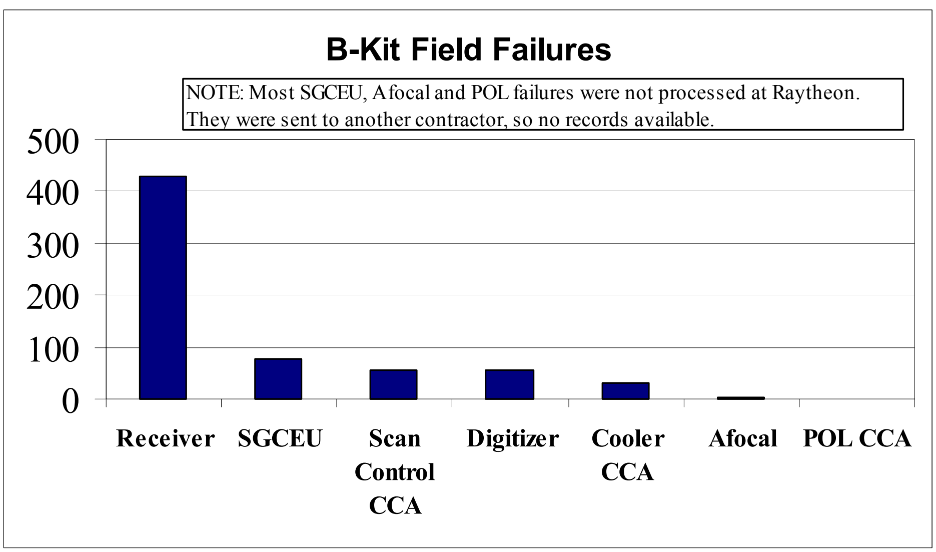


Figure 4-3-12. B-Kit Field Failures

Of the roughly 2044 Receivers in the field, 429 (21%) have been returned for failures. If the Receiver had the same reliability numbers as the other B-Kit components, it would be reasonable to expect a more even rate of return for all items. In other words, each component would have roughly the same 6.65% return rate of the overall B-Kit.

The Receiver, being the highest failed item, needs a further cut to see what is failing. Figure 4-3-13 shows which receiver comonents are failing. It is seen that the Detector/Cooler Bench Assembly has the highest failure rate. The Imager Bench Assembly follows as a close second. This correlates closely with the manufacturing failure data, and, with the exception of the Afocal, also tracks the test failure data. The Afocal is returned to another company for field failures, so Raytheon has no information on those failure numbers.

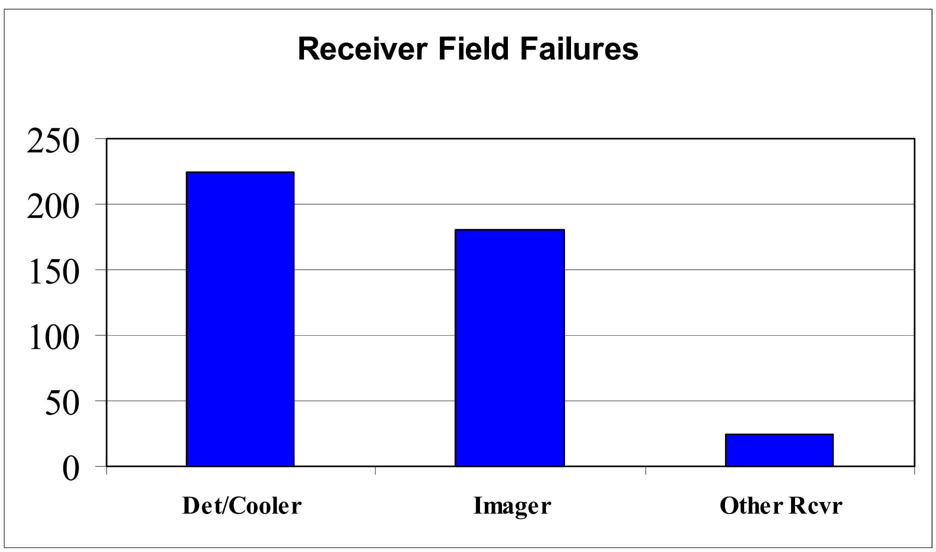


Figure 4-3-12. Receiver Field Failures

Following the process, the next cut is to examine the components of the highest failed item here. Figure 4-3-13 shows what parts of the Detector/Cooler Bench Assembly are failing. As shown, the SADA II has the highest failure rate in the Detector/Cooler Bench. The SADA II is made up of two parts, the dewar and the cooler. Figure 4-3-14 shows the failure rates of those components. The Cooler has the slightly higher failure rate than the Dewar. As previously stated, the SADA II is GFE to Raytheon, thus no actions taken by Raytheon can increase the reliability of this component.

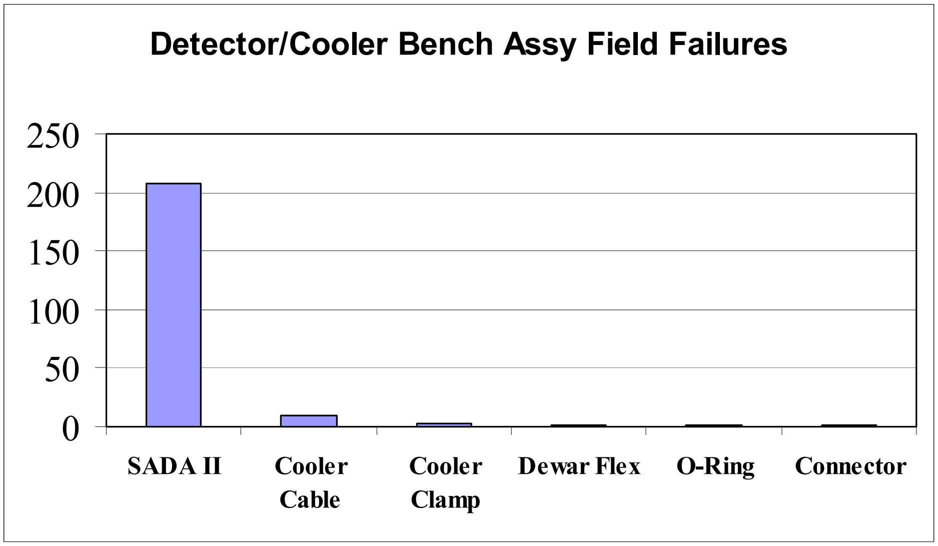


Figure 4-3-13. Detector/Cooler Bench Field Failures

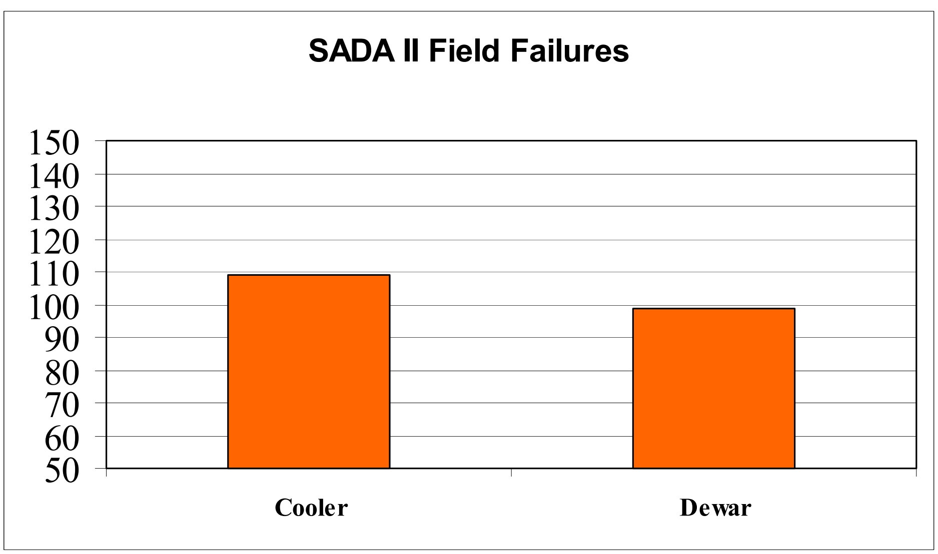


Figure 4-3-14. SADA II Bench Field Failures

From Figure 4-3-12, the second highest failure rate item in the Receiver is the Imager Bench Assebly. Figure 4-3-15 shows the component failures of the Imager Bench Assembly.

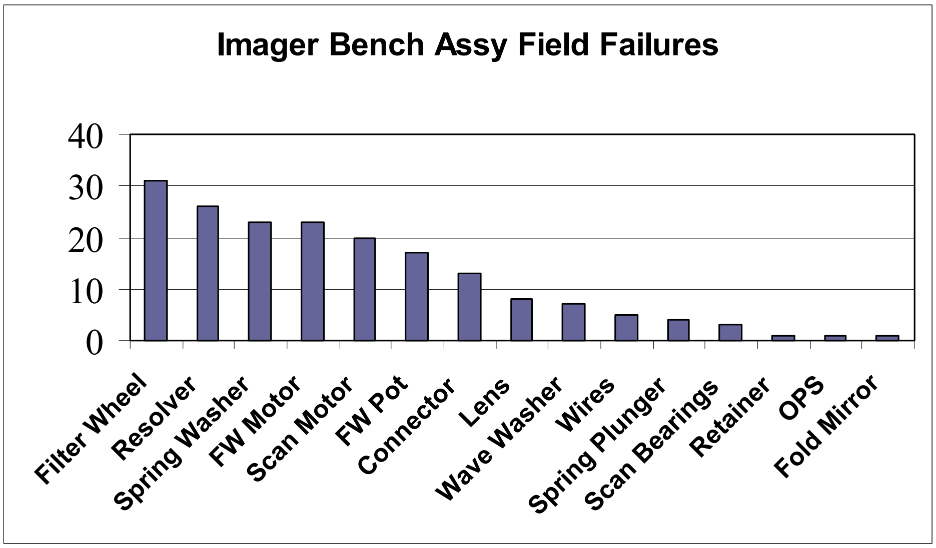


Figure 4-3-15. Imager Bench Assembly Field Failures

Since this assembly is manufactured by Raytheon, actions can be taken to improve the reliability of these components. The filter wheel has the highest failure rate, follwed by the Resolver, the Spring washer, the Filter Wheel Motor, the Scan Motor and the Filter Wheel Potentiometer. Again, this figure demonstrates one of the dangers of using data covering a large period of time. Over the nearly 3 year span of this database, some of these problems have already been addressed. One Filter Wheel problem, the breaking of gear teeth as the wheel was driven into its stops, was corrected with the incorporation of soft stops. This has not eliminated all Filter Wheel problems, but did address about 30% of the failures shown in the figure. The resolver remains an open problem. The Spring Washer and Spring Plunger were a combined problem that was eliminated by a different parts selection. The Filter Wheel Motor, Scan Motor and Filter Wheel Potentiometer remain open problems that shuold be addressed.

The remaining failed items shown in Figure 4-3-12 are such a small percentage in comparison to the Receiver that they will not be discussed here. Further failure plots of all items are shown in Appendix D.

4.4 Design-Change and Process-Change Candidates

Based on the graphs from Paragraph 4.3, Appendix B, Appendix C, Appendix D and user input, the Design-Change Candidates list shown in Table 4-4-1 was generated.

Table 4-4-1. Initial Design-Change Candidate List

Design-Change Candidate	**Specific Action**
SADA II (Detector/Cooler Bench of Receiver)	Improve reliability
Video Converter CCA	Improve Afocal FOV switch circuitry
Filter Wheel Potentiometer (Imager Bench of Receiver)	Find suitable substitute with higher reliability
Afocal	Redesign FOV Switch Mechanism, Focus Mechanism
Filter Wheel Motor (Imager Bench of Receiver)	Find suitable substitute with higher reliability
Resolver (Imager Bench of Receiver)	Find suitable substitute with higher reliability
Scan Motor (Imager Bench of Receiver)	Find suitable substitute with higher reliability
SGCEU Fan	Eliminate

The data showed the largest perentage of failures were from the Recevier, so the majority of the suggested canditates are from the Receiver; the SADA II from the Detector/Cooler Bench and 4 items from the Imager Bench Assembly. The Afocal was selected because it had the highest number of failures during test. The Video Converter CCA was selected because it failed in the last RGT, and the SGCEU fan was selected from strong user input.

Based on the graphs from Paragraph 4.3, Appendix B, Appendix C and user input, the Process-Change Candidates shown in Table 4-4-2 were selected.

Table 4-4-2. Process-Change Candidates

Process-Change Candidate	**Specific Action**
SADA	More stringent screening prior to assembly
Imager Bench Assembly of the Receiver	More precise balancing of scan mirror
Torque of screws	Better tools and more operator training

4.5 Costing, Cost/Benefit Trade Studies and Risk Analysis

The cost to implement each of the Design-Change and Process-Change candidates was estimated. Exact financial details of the cost estimation are not included in this report, as it was concluded that those details would give away too many Raytheon competitive advantages. Included in the total cost were materials needed, engineering hours required for redesign, drawing changes required, Assembly Instruction (AI) changes required, operator training, and qualification testing.

The cost savings for each failure were also estimated. A dollar amount was estimated for each step in the manufacturing process. A dollar per hour value was estimated for troubleshooting of failures. Dollar estimates were assigned for shipping and handling of each B-Kit assembly, those values were weighted estimates based upon where in the USA or the world the assembly might be shipped, and to which customer. B-Kit assemblies have been shipped to/from Pakistan, Kosovo, Russia, England, Saudi Arabia, and many U.S. Army bases. The two main shipping points in the USA are currently Lima, Ohio and Palm Bay, Florida.

Once each of these costs is set, the amount of time each failure requires in troubleshooting and rework through manufacturing processes is estimated. The total cost of each failure was calculated by multiplying the cost in troubleshooting and rework by the number of times that failure occurred in the past 12 months. A fudge factor was used to account for any failures the new design or process might cause.

The cost/benefit trade studies did not eliminate any candidates. The payback period for the Design-change candidates is estimated to be 2 years 3 months, assuming the current production rate continues. The payback period for the Process-Change candidates is 4 months.

Risk analyses were performed on each of the candidates to ensure that all possible problems have been considered, and that no extra reliability risks are being added to the B-Kit based on these proposed changes.

4.5.1 B-Kit Reliability Modeling Software Tool

A decision was made not to change to the PRISM® reliabililty software tool at this point in time, as it is too new to Raytheon. A few test programs are trying it over the next several months, and results will be evaluated. Because the RGT is expected to take 6-8 months to complete, there is time to implement this tool and still tweek and validate using the new RGT number.

New part selections for the Afocal and Receiver were made using the indusry-supplied reliability numbers, along with reliability information from Reliability Assessment Center [RAC4].

4.6 Implementing B-Kit Changes

The items listed in Table 4-6-1 were those design-change candidates that survived the combination of cost/benefit trade studies, make-sense analysis and time constraints. Notice that, of the 3 B-Kit failed item from the last RGT, none made the final list. The SADA II was eliminated because it is GFE to Raytheon, so we do not have the capability to improve its reliability or to choose a new supplier. The Video Converter CCA was eliminated because a fix for the Afocal FOV circuitry was implemented immediately. The Filter Wheel Potentiometer was eliminated because of time constraints. The lead-time for that order was longer than that allowed for the design changes. It remains a future design-change candidate, and will become a forced change if it fails again in the next RGT.

Table 4-6-1. Final Design-Change Items

Design-Change Candidate	Specific Action
Afocal	Redesign FOV Switch Mechanism, FOV Mechanism
Filter Wheel Motor	Find suitable substitute with higher reliability
SGCEU Fan	Eliminate

The new Afocal design, the new SGCEU design and the process changes were all made with reliability as a key factor.

4.6.1 B-Kit Design For Reliability

New part selections for the Afocal and Receiver were made using the industry-supplied reliability numbers, along with reliability information from Reliability Assessment Center [RAC4]. A key component of the Afocal focus mechanism was chosen, a prototype was built, then the component was replaced when it was discovered that it would not pass the Radiation Harness requirement for the B-Kit. Two areas of concern on the new Afocal are the stability of the focus mechanism during vibration and the set point of the focus mechanism.

4.6.2 B-Kit DVT

A DVT was run on the new B-Kit system design. No new filter wheel motor had been identified, so no Receiver changes were made prior to DVT. No suitable motor could be found.

The Qualification-type tests that were chosen to be run were High and Low Sotrage and Operating Temperatures, B-Kit Vibration, B-Kit Basic Shock, B-Kit Gunfiring Shock and B-Kit Ballistic Shock (Afocal Only). These tests were chosen because they had the greatest possiblity of showing any trouble areas in the new design.

Some problems with the new Afocal were encountered. First, the Afocal could not be focused correctly at –40°C durng the MRTD and Range Focus tests. Much troubleshooting of both the Afocal CCA and the Afocal focus mechanism were performed. Errors with both were found. A perisistent short in the Afocal CCA was found and corrected. The focus set point was manually set for the two Afocals under test. It was discovered that these focus set points were very sensitive, and a more exact method of setting them was established.

It was also learned that the focus lense sets used in the first 2 new Afocals were not the original lenses supplied with the Afocal. This could have affected focus, much the same way a person picking up a sibling's eye glasses might be affected. The prescription might be close, but the chances of matching the original prescription perfectly are very small. Some focus problems would be expected if you tried to use their eye glasses.

Once the short and the focus set point were corrected, the Afocals were able to focus properly. Once Afocals are built with the correct prescription in all lense cells, focus will probably improve a slight amount more.

Next, the Afocal was setting FOV Position BIT flags, meaning it either was not in the FOV that was commanded, or it went into the correct FOV, then slightly bounced out of position. Upon examination, it was discovered that the FOV mechanism was not properly pre-loaded. The washer and spring that were providing the pre-load were loose. The washer had flattened. Both were redesigned and installed in the Afocal. This Afocal was then subjected to all of the DVT environments again. It passed. This is the design the went forward into production.

4.6.3 Process Control

The graphs in Paragraph 4.3, Appendix B, Appendix C, and Appendix D show that the workmanship needs some improvement. Statistical process controls currently being used to monitor the manufacturing process are not adequate. Workmanship corrective actions must be made more effective and more permanent.

4.6.4 Supplier Control

Supplier Control on the NV-80 B-Kit has been problematic in the past, especially the bearings, filter wheel motors, plunger stops and lubricants used in the Receiver. To help in controlling suppliers better, some parts on the B-Kit drawings were made into "required purchase" from a specific vendor.

4.6.5 Configuration Control

A request by PM FLIR to balance the number of SADA II's delivered to Raytheon with the number of SADA II's belonging to PM FLIR in Receivers or shipped back to the Original Equipment Manufacturer (OEM) showed holes in our Configuration Management process. We had a solid handle on which SADA II was sent out in the original Receiver. What we missed was what SADA II was installed when the Receiver was sent back to us for repair. We are still trying to balance those numbers.

Also, a change to the Digitizer CCA to accommodate a difference in SADA II timing between OEM's pointed to another CM hole. No tracking of which digitizers had been modified was done. When a Receiver failed in the field, we couldn't tell PM FLIR which piece to send back, the Reciever or the Digitizer.

These problems were addressed in an update to the B-Kit Configuratino Management Plan. Stronger configuration management should help to improve the B-Kit reliability.

4.6.6 B-Kit HALT

After the B-Kit completed DVT (Paragraph 4.6.2), it was subjected to a HALT. No overt design weaknesses were found. However, upon inspection after testing was complete, additional problems with the washer and the FOV mechanism were found and corrected.

4.7 Qualification Testing

Seven B-kits, 4 inside A-Kits, began Qualification testing in August, 2002. Of these seven, two A-Kits and two B-Kits are being subjected to the RGT. The remaining 3 B-Kits are being used to qualify the system from a Performance and Environmental perspective. As failures occur, troubleshooting, analysis and corrective action occur. Failure data as of 10/10/02 are shown in Appendix E.

4.8 Future Activities

After Qualification testing is completed, a new system reliability number will be calculated, using only the Qualification test failure data. The method for calculating the system reliability will be the same as that used in Paragraph 4.2. The two results will be compared to see if the system redesign has been successful.

The new reliability number will also be compared with the number supplied by the reliability software tool that will be implemented by December. If the software tool is used properly, these numbers should correlate closely. This will validate the reliability modeling tool, so that the modeling tool can take the place of expensive future RQT or RGT.

4.8.1 Cost Savings Calculations

As failure data continues to be collected during manufacturing and fielding, it will also be used to calculate cost savings.

4.8.1.1 Manufacturing Cost Savings

The cost of a manufacturing failure was estimated at every step in the production process was estimated in Paragraph 4.5. The cost of manufacturing failures during the 12 months prior to the system redesign have been calculated. After 3 months of producing the new system design, the cost of manufacturing failures during that 3 months will be calculated. This cost will be compared with the cost during the previous 12 months of manufacturing the old design. If the reliability improvement process was successful, the cost should be lower by approximately the same percentage as the improvement in reliability.

4.8.1.2 Warranty Cost Savings

The cost savings for warranty work will not be as large as the cost savings seen in manufacturing because units with the old system design are still failing in the field. The cost savings on warranty work will be calculated based on the formula in Paragraph 3.9.2. If the reliability improvement is successful, the cost savings seen from warranty work should decrease over time. The first warranty work cost savings will be calculated 12 months after the first production of the new B-Kit design. This cost savings should increase over time if the Reliability Improvement process is successful.

4.8.1.3 Test Failure Cost Savings

The next Qualification test is contractually scheduled for August, 2004. This test will be performed to ensure that any minor changes in manufacturing parts or processes during the 2 years since the last test have not degraded system performance. The test failure cost savings will be calculated by taking the number of test failures and multiplying them by the correct manufacturing costs of troubleshooting, rework and repair estimates from Paragraph 4.5. The test failure cost savings will be compared to the last Old System Design test of similar scope. The percentage of test failure cost savings should be approximately the Reliability Improvement percentage.

The total cost savings will be calculated as the sum of the Manufacturing Cost savings, Warranty Cost savings and Test Failure Cost savings. The redesign payback period will be estimated at when the first Warranty Cost savings is calculated (12 months after the first system is fielded).

4.9 Continuous Improvement

Continuous product improvement will occur by continuing to collect and analyze Manufacturing, Test and Field failure data, and to implement corrective actions as failure trends emerge. Constant attention to Process Control and Supplier Control will also help in the continuous improvement of the system.

Chapter 5
Conclusions and Recommendations

The research performed for this report was an eye-opening experience The in-depth look at all designs, processes and procedures associated with the making of the B-Kit was enlightening. Many items, not specifically addressed in this report, were corrected along the way.

5.1 Recommendations

There are a number of areas of both B-Kit design and manufacturing that should be re-examined with a longer time event horizon for implementation.

It is recommended that 3 or 4 strategically placed 100% QC points be inserted back into the manufacturing process, especially in the Receiver and SGCEU manufacturing processes. This will help to ensure that the workmanship errors are cut down.

It is also recommended that a more rigorous IV&V program be instituted to ensure that corrective actions really do fully correct failures. This will require both time and money – two things in short supply on the B-Kit program. When a failure occurs, it usually stops test and/or production, so pressure is high to get it fixed and get production moving again because time is money. As was shown by the graphs in section 4.3, this only pushes the failure problem into the next testing cycle, and inevitably costs more money.

It is recommended that the PRISM® tool be implemented on the B-Kit program to better model Reliability predicitions. This tool will help the design engineers during the parts selection process.

It is recommened that the production flow be forced to become more linear, or that production throughput be cut back to accommodate non-linear flow. Not having parts until the 20t[h] of the month, yet still expecting to get 20 systems through the factory puts impossible pressure on the operators month after month. This pressure is reflected in the workmanship errors. This may mean moving away from the "just-in-time" stock process.

It is recommended that more rigorous troubleshooting practices be instituted. The "sho-gun" method-- pulling CCAs until the problem disappears, with the last one obviously being the defective CCA -- is not systematic, nor is it repeatable. Then, to compound this problem, the B-Kit is sold before the 'problem' CCA is examined for root cause and corrective action. When no problem is found on the 'problem' CCA, that means one of two things: there is either an interface problem between assemblies in that particular B-Kit that needs further investigation, or that particular B-Kit was sold with an intermittent failure. Either way, the ability of the engineers to find the problem and correct it is gone because the B-Kit is gone. If B-Kits that failed during the manufacturing process were held until corrective action was determined, less field returns would occur. Of course, this would mean putting more B-Kits in flow each month to ensure that delivery schedule was met. A 10% increase in B-Kit flow would account for the failed B-Kits.

It is recommended that a B-Kit or B-Kit subassembly that fails a step in the manufacturing process (UT, ESS or AT) be required to pass that particular step 2 times for each time it failed the step. This will help to prevent intermittent failures from slipping through. For example, a B-Kit that fails ESS three times should be required to pass six (3*2) failure-free ESS cycles.

It is recommended that uniform database terminology be instituted between the 3 major databases (test, manufacturing and field data). An example of the need for this step is the terminology used in the manufacturing database. The term ""EU" was used interchangeably to mean the SGCEU and the A-Kit SEU. Software containing pulldown menus might help this problem.

5.2 Conclusions

The process developed during this research work has not yet been verified by test. The RGT is on-going to achieve the greater than 2X improvement in B-Kit MTBF. It is expected that not enough design changes were made to accomplish the 2X increase, and that more design changes are possible.

The generic process was developed to be used on any equipment, whether it is a FLIR or a bicycle – if the bicycle has sufficient parts count to be called a complex system. Working through the process is an excellent learning experience for an engineer, and might be very beneficial to new engineers on the program, even if there is not a real reliability problem.

Chapter 6

Acronym List

AT - Acceptance Test

CCA - Circuit Card Assembly

CE/FI - Contrast Enhancement/ Frame Integration

CM – Configuration Management

COTS - Common-Off-The-Shelf

DCMA - Defense Contract Management Authority

DVT – Design Verification Test

EEPROM - Electrically Erasable Programmable Read-Only Memory

EMD - Engineering and Manufacturing Development

EMI - Electromagnetic Interference

EO - Electro-optical

ESS - Environmental Stress Screening

FIAR – Failure Incident Analysis Reporting

FLIR -Forward Looking Infrared

FMS – Fialure Monitoring System

FOV - Field of View

FPA - Focal Plane Array

FQT - Full Qualification Test

FRACAS – Failure, Reporting, Analysis and Corrective Actions System

HALT – Highly Accelerated Life Test

HASS – Highly Accelerated Stress Screening

HTI - Horizontal Technology Integration

IBIT - Operator Initiated Built-In Test

ICD - Interface Control Document

iMTBF – Instaneous Mean Time Between Failures

IPT - Initial Production Test

LBS - Pounds

LRIP - Low Rate Initial Production

LRU - Line Replaceable Unit

MSN - Manufacturer's Serial Number

MTBF – Mean Time Between Failures

MTBMAF – Mean Time Between Mission Affecting Failures

NFOV - Narrow Field of View

NVL – Night Vision Labs

POL - Point of Load Regulator

PM FLIR - Program Manager Forward Looking InfraRed

QA – Quality Assuarance

QI – Quality Inspection

R&M – Reliability and Maintainability

RAC – Reliability Analysis Center

RFR – Reliability Failure Reporting

RGT – Reliability Growth Test

RQT – Reliability Qualification Test

RI – Reliability Improvement

SGCEU - Second Generation Common Electronics Unit

SPC – Statistical Process Controls

SRU - Shop Replaceable Unit

SU - Sight Unit

TI - Texas Instruments

TRS - Temperature Reference Signal

UUT - Unit Under Test

VC – Video Converter CCA

VP – Video Processor CCA

VS or vs - Versus

WFOV - Wide Field of View

Chapter 7

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[Ray12] Raytheon Document, "Source Development IPT/Bridge CI Performance/Environmental Test Report." U0140Y9K, Aug 10, 2002, Test Report.

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[RAC2] Reliability Analysis Center (RAC), Blueprints for Product Reliability: Ensuring Reliable Performance. RBPR-6, Dec 15, 1996, Rev 1.0, Rome, NY.

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[RAC4] Reliability Analysis Center (RAC) web site, http://rac.iitri.org/
(The Reliability Analysis Center (RAC) is a Department of Defense (DoD) chartered Information Analysis Center (IAC) sponsored by the Defense Technical Information Center (DTIC). RAC is operated by Illinois Institute of Technology (IIT) Research Institute (IITRI). This web site offers much information on Reliability and Maintainability, including an FAQ section, Comprehensive searchable R&M Library, Parts Reliability Data, Software Tools Directory, R & M Standards Directory, Related Web Sites.)

[RAC5] Reliability Analysis Center (then doing business as Rome Air Development Center), RADC Reliability Engineer's Toolkit, July 1988.

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Chapter 8

Appendices

APPENDIX A

Reliability Calculations

Reliability Calculations

Measured Mean-Time-Between-Mission-Affecting-Failures (MTBMAF) for the NV-80 B-Kit, based on RGT test results are summarized in the following table. [Ray10]

Table 3. RGT MTBMAF Summary Test Results

Hardware	Lower One-Sided Limit MTBMAF (hours) (as used)	Instantaneous MTBMAF (Hours) (as used)	Lower One-Sided Limit MTBMAF (Hours) (Growth)	Instantaneous MTBMAF (Hours) (Growth)	Specified Mission (Hours)	Specified Probability (%)	Specified MTBMAF @ 80% Level (hours)
NV-80 B-Kit	223	445	461* >482** >782**	1249* >1905** >3092**	44	95	850
NV-80 B-Kit (less SADA II)	196	530	CBD***	CBD***	44	95	1200

* = Calculation based on no corrective action for all GFE SADA II failures during RGT test period.

** = Calculation based on only 1 GFE SADA II failure during RGT period with corrective action identified. MTBMAF value dependent upon time phasing of SADA II failure with corrective action identified/implemented. The higher MTBMAF value signifies the failure earlier in the test.

*** = Cannot Be Determined (CBD). Calculation either based on all GFE failures having corrective actions or SADA failures not included in analysis. Either situation results in a total of no failures events, a condition not supported by the AMSAA model.

Note: As used means raw numbers, with no corrective actions identified or implemented.Growth means that corrective actions were identified and implemented.

A total of 4 Mission-Affecting failures occurred in the NV-80 B-Kit. A Mission-Affecting failure is defined as any failure that prevents or severely compromises the completion of the 44-hour mission. These failures were used to determine the point estimate MTBMAFs for the as-used or current configuration.

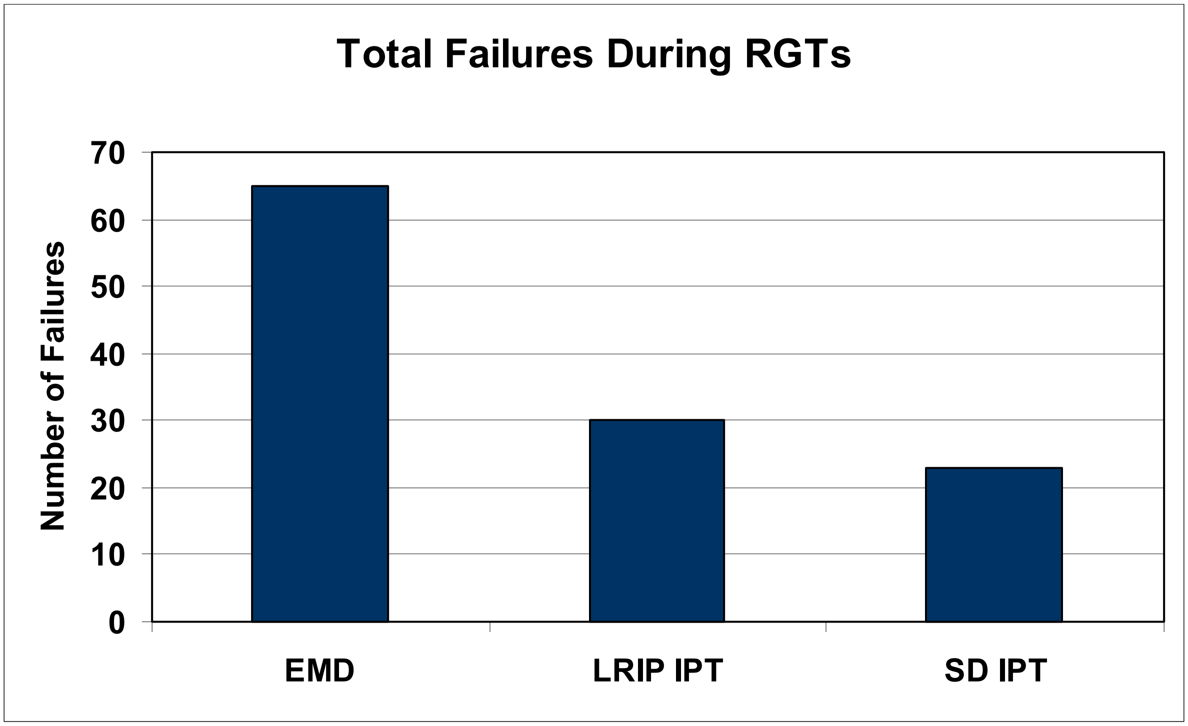
Two of the B-Kit failures have had corrective action implemented. The GFE SADA II failures do not have corrective actions identified at this time. However, the customer allows us to postulate MTBMAF numbers for corrective actions for one or both of the failures.

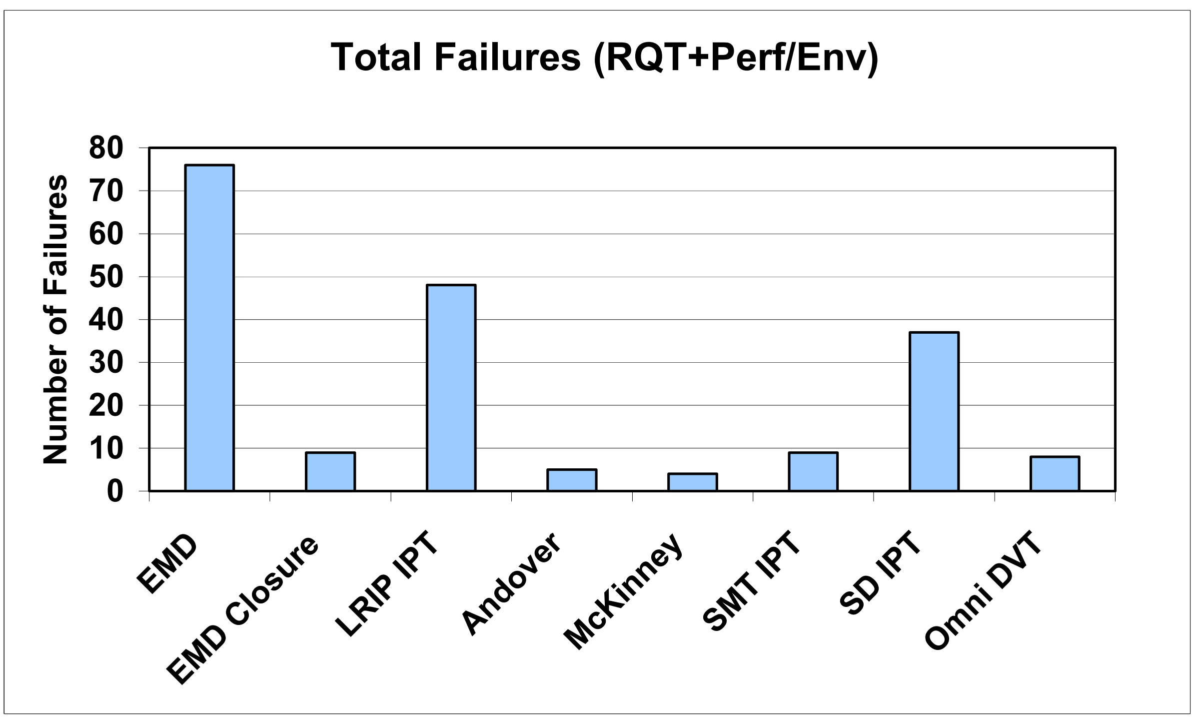
The MTBMAFs are based on two systems, one with 1057 on-time hours and the second with 1022 on-time hours, for a combined total of 2079 on-time hours. The SADA II failures occurred 313.5 hours and 480.5 hours. The AMSAA model uses the system on-time of the failure as part of the MTBF calculation. Early failures are penalized less because they are assumed to be 'infant-mortality' type failures, and are not likely to occur again if no corrective action is taken. Later failures are penalized more heavily because they usually indicate a design flaw, and are more likely to occur again if no corrective action is implemented.

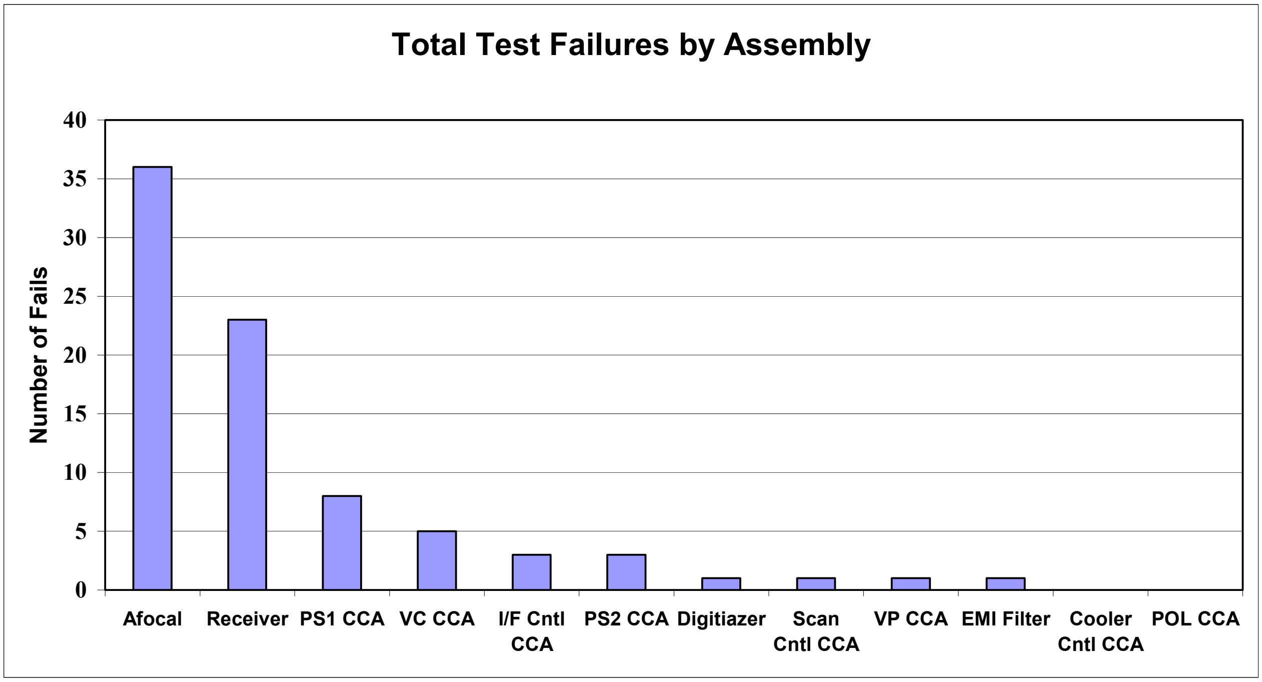
APPENDIX B

Analyses of B-Kit Test Failure Data

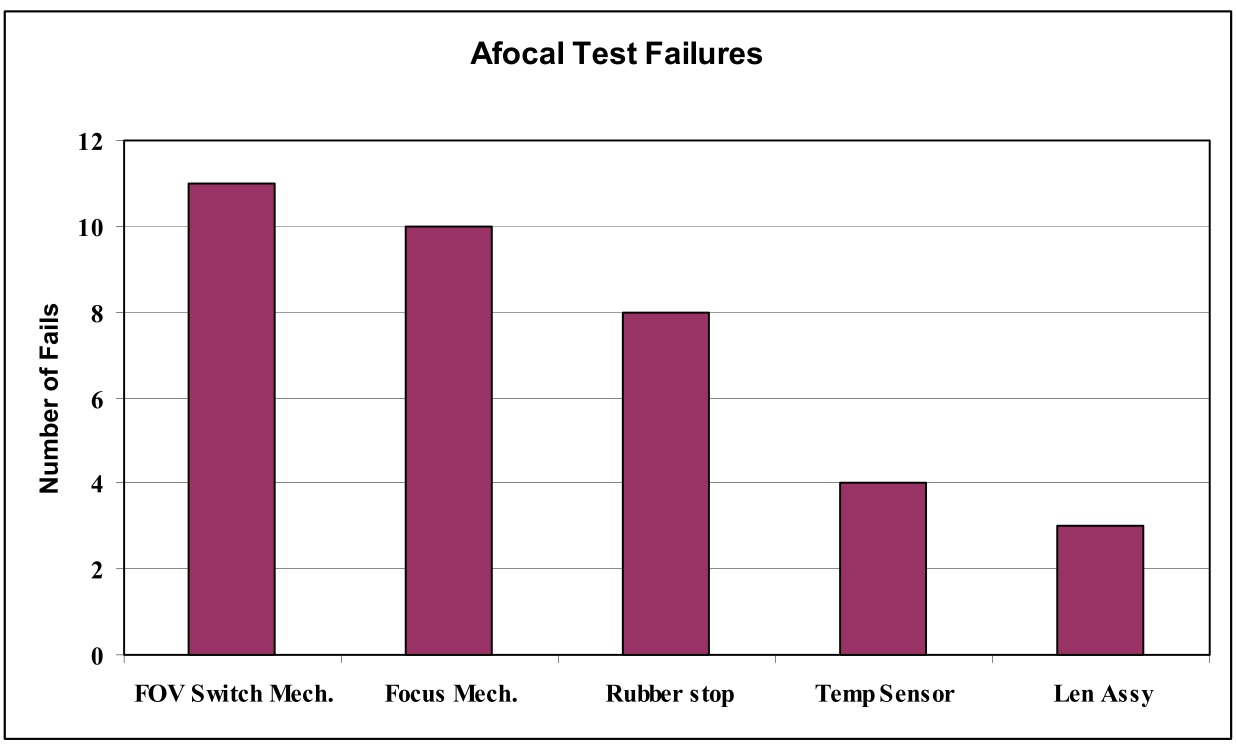
Figures


Total Failures During RGTs
Number of Failures
70
60
50
40
30
20
10
0
EMD
LRIP IPT
SD IPT

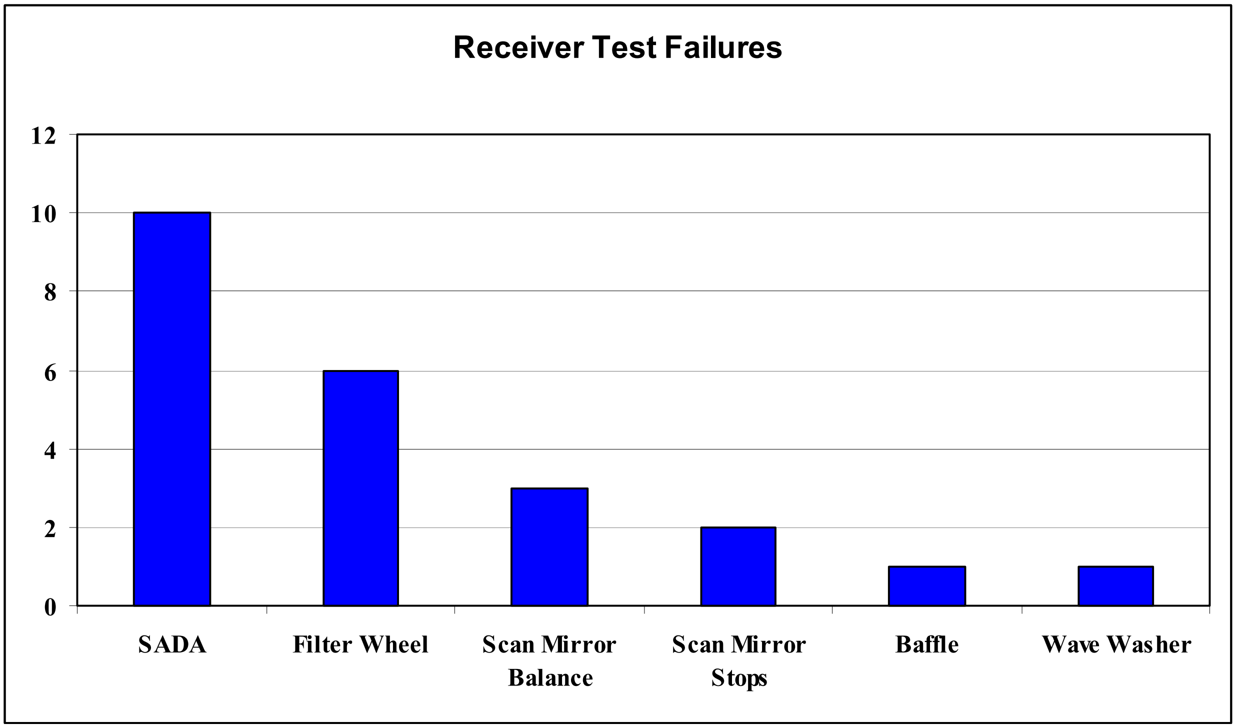

Total Failures (RQT+Perf/Env)
Number of Failures
80
70
60
50
40
30
20
10
0
EMD
EMD Closure
LRIP IPT
Andover
McKinney
SMT IPT
SD IPT
Omni DVT

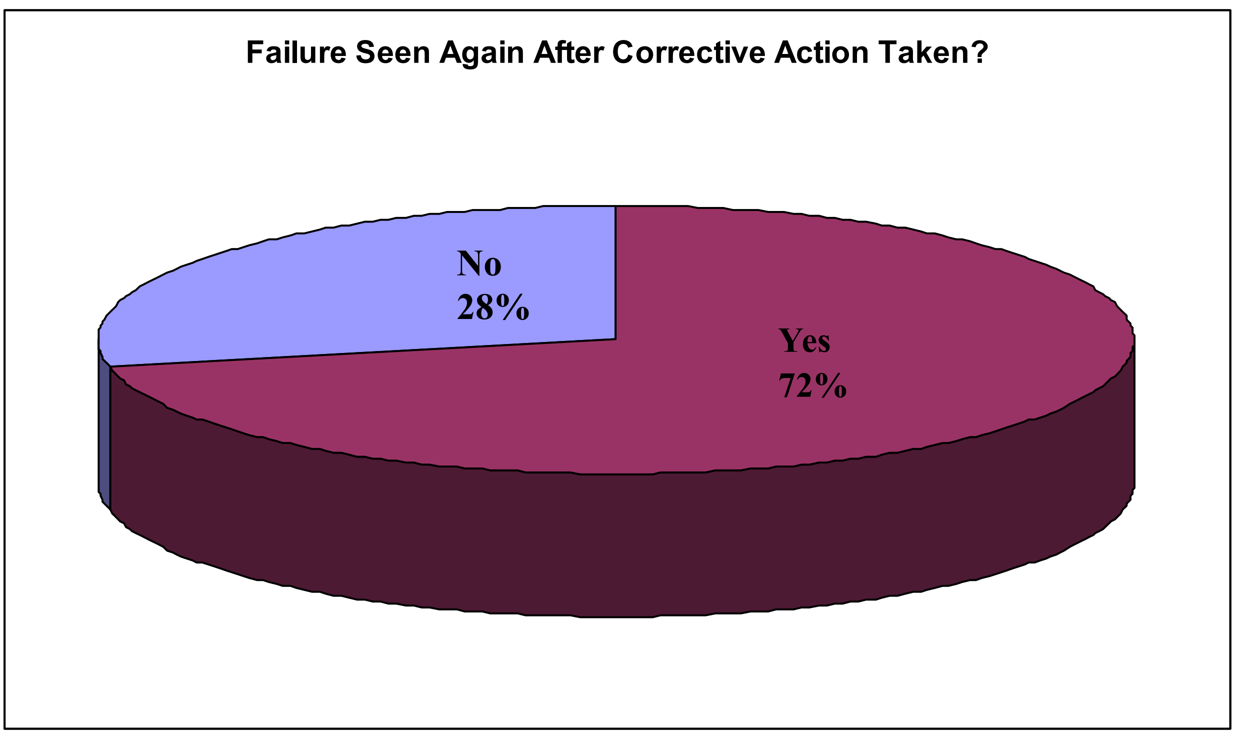


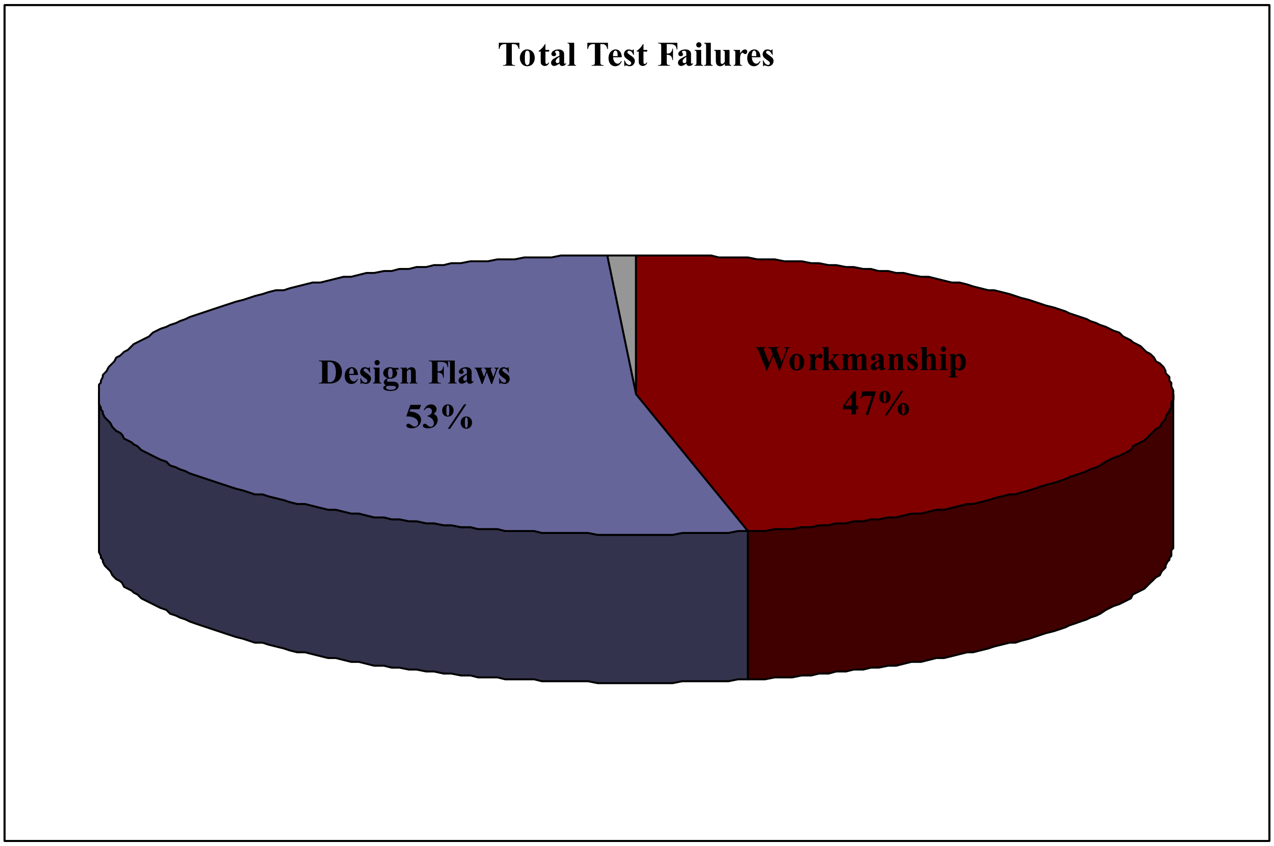
Total Test Failures by Assembly
Number of Fails
40
35
30
25
20
15
10
5
0
Afocal
Receiver
PS1 CCA
VC CCA
I/F Cntl CCA
PS2 CCA
Digitiazer
Scan Cntl CCA
VP CCA
EMI Filter
Cooler Cntl CCA
POL CCA



Afocal Test Failures
Number of Fails
12
10
8
6
4
2
0
FOV Switch Mech.
Focus Mech.
Rubber stop
Temp Sensor
Len Assy


Receiver Test Failures
12
10
8
6
4
2
0
SADA
Filter Wheel
Scan Mirror Balance
Scan Mirror Stops
Baffle
Wave Washer


Failure Seen Again After Corrective Action Taken?
No 28%
Yes 72%


Total Test Failures
Design Flaws
53%
Workmanship
47%

Test Data

Reliability and Perf/Env Testing Fails minus Operator error and test equipment error						
Failed Item	**Number**	**Lower level Part**	**Root Cause**	**Corrective Action**	**Seen again in later tests?**	**Design flaw or Workmanship?**
EMD Rel Test						
Az Drive	4	Az Lock Assy	Az lock Assy misaligned	Revise assembly Instructions	Y	W
SEU	12	Servo Power CCA	Iso Amplifier failed	Redesign to add resistors to protect Iso Amp	Y	D
SEU	1	O-Ring	Damaged during R&R of Servo Power CCA	replace o-ring	Y	W
Slip Ring	5		Intermittent Fail on Directional signal control line	Redesign Slip Ring with redundant slips (L)	Y	D
Software	2		BIT error	Upgrade Software for BIT in next SW release	N	D
Servo Interface CCA	4		BIT logic error	Reprogram FPGA BIT logic	N	D
Afocal	6		Rubber stop	Redesign stop	Y	D
Sight Unit	2		failed leak test	Revise assembly Instructions to torque and pot connectors differently	Y	W
Afocal	3		TRS 2 overheat	unknown	Y	D

Headmirror	12		Headmirror bearings binding, Headmirror not balanced correctly	Select new bearing mfr, Revise assembly instructions	Y	D & W
SEU	1	Servo Power CCA	cold flow solder	Revise Assembly Instructions	Y	W
Afocal	1		loosed screw in focus mechanism	Revise OEM assembly instructions	Y	W
Receiver	1	SADA	Low Helium Pressure in Cooler	Revise OEM assembly instructions	Y	D&W
Slip Ring	10		Open Slips	Redesign for redunant slips(L)	Y	D
SGCEU	1	Video Converter CCA	initialized at incorrect baud rate	Relayout VC CCA with pull up/down resistors to correct problem	Y	D
Total	65				Total Y=47	Total W= 20
						D=56
LRIP Rel Test						
Receiver	1	SADA	C&CE	Revise C&CE	yes	D
SGCEU	1	Interface Control CCA	Timing issue	added resistors	yes	D
Slip Ring Assy	1		slips open	redundant slips	No	D
Receiver	1	Filter Wheel	software threshold set incorrectly	reset software threshold	No	D
SGCEU	1	Video Converter	PROM upgrade incomplete	PROM upgrade instructions improved	No	W
Afocal	1		focus stop	redesign (L)	yes	D
Afocal	1		FOV position arm	redesign (L)	yes	D
Receiver	1	Scan mirror	Scan mirror alignment in Receiver (L)	Align Scan mirror differently (L)	yes	W

Head Mirror	1	Bearings/Alignment	Bearing /Mirror alignment	New bearings, revise alignment procedure	yes	W
Receiver	1	SADA	C&CE	Revise C&CE	yes	D
Az Drive	1	Az Lock Assy	Az lock Assy misaligned	Revise assembly Instructions	yes	W
Receiver	1	Filterwheel motor	sheared motor gear teeth	soft stops (L)	yes	D
Slip Ring Assy	1		slips open	redundant slips	No	D
Az Drive	1	Az Lock Assy	Az lock Assy misaligned	Revise assembly Instructions	yes	W
Az Drive	1	Az Lock Assy	Az lock Assy misaligned	Revise assembly Instructions	yes	W
Receiver	1	SADA	Helium charge low	replace C seal, recharge helium	yes	W
Receiver	1	Scan mirror	Scan mirror alignment in Receiver (L)	Align Scan mirror differently (L)	yes	W
Receiver	1	Filter Wheel	software threshold set incorrectly	reset software threshold	No	D
Az Drive	1	Az Lock Assy	improper alignment	Revise assembly Instructions	yes	W
SGCEU	1	Video Converter	PROM upgrade incomplete	PROM upgrade instructions improved	No	W
Afocal	1		focus stop	redesign (L)	yes	D
Slip Ring Assy	1		Base Crack	Strengthen Epoxy	No	D
Az Drive	1	Az Lock Assy	improper alignment	Revise assembly Instructions	yes	W
Slip Ring Assy	1		Base Crack	Strengthen Epoxy	no	D
Receiver	1	SADA	Helium charge low	replace C seal, recharge helium	yes	W
SGCEU	1	Power Supply 1	Scan mirror alignment in Receiver (L)	Align Scan mirror differently (L)	yes	W

SGCEU	1	Interface Control CCA	Master Ram Chip	Replace White Brand	No	D
Slip Ring Assy	1	wires	wire chafing	shorten wire harness, mylar tape	yes	W
Slip Ring Assy	1	wires	wire chafing	shorten wire harness, mylar tape	yes	W
Az Drive	1	bevel gear	Bevel gear assy misaligned	Revise assembly Instructions	yes	W
total	30				Seen again 2 yrs later?	Total W= 16
					Yes = 21, No =9	Total D = 14
Source Dev Rel Test						
Afocal	1		Focus Position	unknown		D
SU Fan	1		wiring short	Modified wiring	N	W
SU Fan	1		wiring short	Modified wiring	N	W
Head Mirror	1		out of balance	Revised Assembly Instructions	Y	W
Afocal	1		Focus Position	unknown		D
Afocal	1		FOV	unknown		D
Receiver	1	SADA	Serial IO	timing		D
SGCEU	1	Power Supply 1		unknown		
Afocal	1		FOV	unknown		D
Afocal	1	Afocal Temp sensor	wire potting	change potting method		W
Receiver	1	SADA	unknown	unknown		D
Receiver	1	Filter Wheel assy	potentiometer	wiper wear	N	D
Slip Ring Assy	1		broken wire	strain relief		W
Az Drive	1		Misalignment	Revised Assembly Instructions		W
Slip Ring Assy	1		Misassembly	Revised Assembly Instructions		W
Slip Ring Assy	1		wire insulation damage	round corners on cap		D
Afocal	1		Focus Position	unknown		D

SEU	1	wedgelocks	screws backed out & conformal coating on edges	Revised Assembly Instructions		W
Slip Ring Assy	1		broken wire	strain relief		W
SEU	1	Servo Interface CCA	ICs	secondary to wedgelocks fail		W
Head Mirror	1		out of balance	Revised Assembly Instructions	Y	W
SGCEU	1	Video Converter CCA	FET Q1	redesign FOV drive circuit		D
Afocal	1	motor	overdrive to motor from Video Converter CCA FET Q1	redesign FOV drive circuit		D
total	23					Total W=11
						D=11
						unknown = 1
EMD Perf/Env						
Armor	1		paint peeling, armor rust	Revise paint application instructions	Y	W
Afocal	1		Rubber stop	Redesign stop	Y	D
SEU	1		excess locktite on screws allowed moisture into SEU	Revise assembly instructions	Y	W
SEU/SCGEU	1		Improper grounding assembly	Revise assembly instructions	Y	W
Az Drive	1	Az Lock Assy	Az lock Assy misaligned	Revise assembly Instructions	yes	W
Sight Unit	1	Gyro resolver	Cold temperature derating	Changed spec to remove temperature testing	N	D

SGCEU	1	pins	bent pins	Redesign using stronger pins (L)	Y	D
Slip Ring (L)	1		slips open	redundant slips	N	D
Slip Ring (L)	1		slips open	redundant slips	N	D
Receiver	1	wavewasher (L)	wave washer compresses and releases excessively during vibration, causing video "movement"	redesign wave washer (L)	Y	D
Az Drive	1	Az Lock Assy	Az lock Assy misaligned	Revise assembly Instructions	yes	W
Total	11					Total W=5
						D=6
EMD Closure Test						
Afocal	1	FOV Mechanism	Metal hits metal when changing FOV	none	Y	D
Receiver	1	Filter Wheel Assy	Metal hits metal when changing filters	none	Y	D
SGCEU	1	Fan Assy	motor and blades make noise	spec change	N	D
B-Kit	1	Receiver (L) and Afocal	fails to hold perfect focus at +/- 20C	change software Atherm coefficients	Y	D & W
Receiver	1	SADA	SADA Bad Channels	unknown	Y	D
Afocal	1	Focus Mechanism	rubber stop	Redesign rubber stop	N	D
Afocal and Receiver	1		fails Atherm, doesn't hold perfect focus over 20C change.	Revise software coefficients	Y	D&W

Az Drive	1	Az Lock Assy	Az lock Assy misaligned	Revise assembly Instructions	yes	W
Receiver (L)	1	Scan mirror	Scan mirror alignment in Receiver (L)	Align Scan mirror differently (L)	yes	W
Total	9					Total W=4
						D=7
LRIP Perf/Env Test						
B-Kit	1	Receiver (L) and Afocal	fails to hold perfect focus at +/- 20C	change software Atherm coefficients	Y	D & W
Receiver	1	baffle	reflections	redesign baffle	N	D
Afocal	1	Lens Assy	potting and position of lenses failed FOV at temperature	none	Y	D &W
Receiver	1	SADA	Dead Channels	unknown	Y	D
SGCEU	1		Short in pins in J3	replace pins	Y	W
SGCEU	1		Grounding opens and shorts	Revise Assembly Instructions	Y	W
SEU	1		Grounding opens and shorts	Revise Assembly Instructions	Y	W
Az Drive	1	Az Lock Assy	Az lock Assy misaligned	Revise assembly Instructions	Y	W
CITV	1	o-rings	material absorbs diesel and hydraulic fluid	none	Y	D
B-Kit	1	software	IBIT takes too long	change spec	N	D
B-Kit	1	Afocal	weighs too much	change spec	N	D
Armor	1		paint peeling, armor rust	Revise paint application instructions	Y	W
Slip ring	1		slips open	redundant slips	N	D

Az Drive	1	Az Lock Assy	Az lock Assy misaligned	Revise assembly Instructions	Y	W
Afocal and Receiver	1		fails Atherm, doesn't hold perfect focus over 20C change.	Revise software coefficients, remove bi-metal washer	Y	D&W
Head Mirror	2	gyro shaft	design could not withstand Ballistic Shock imparted	Redesign	N	D&D
CIVT SU	1		C.G. too high	change Spec	N	D
total	18				Total Y = 9	Total W=9
						D=12
Andover Mini-Qual Test						
SGCEU	1	Master RAM	master RAM failed	Screen parts	N	D
Receiver	1	Scan stops	Spring loading incorrect	Use new vendor	Y	D
Receiver	1	Imager	pinched wires, scan stops set wrong	Revise Assembly Instructions	Y	W
Az Drive	1	Az Lock Assy	Az lock Assy misaligned	Revise assembly Instructions	Y	W
Az Drive	1	Az Lock Assy	Az lock Assy misaligned	Revise assembly Instructions	Y	W
Total	5				Total Y=4	Total W=3
						D=2
McKinney Mini-Qual Test						
SEU	1	SIF	AR125 shorted	Revise Assembly Instructions	N	W
Slip ring	1		cracked epoxy at base	strengthen epoxy	Y	D
Afocal	1		Focus Position	unknown	Y	D
Az Drive	1	Az Lock Assy	Az lock Assy misaligned	Revise assembly Instructions	Y	W
total	4				Total Y=3	Total W=2

						D=2
SMT Perf/Env						
Afocal	1		FOV Position fail	unknown	Y	D
Receiver	1	SADA	OEM timing setting	Mod to Digitizer CCA to compensate for off- timing	N	D
Az Drive	1	Az Lock Assy	Az lock Assy misaligned	Revise assembly Instructions	Y	W
Receiver	1	SADA	unknown	unknown	N	D
Scan Control CCA	1	R155	crack in resistor	screen parts	N	W
Digitizer	1		Conformal coating under wings, socketed parts came loose.	Revise Assembly Instructions to apply wings before conformal coat	N	W
Az Drive	1	Az Lock Assy	Az lock Assy misaligned	Revise assembly Instructions	Y	W
Slip Ring	1		Cracked at base	overtest	N	
Sight Unit	1		loose screws	Revise Assembly Instructions	Y	W
Total	9				Total Y=4	Total W=5
						D=3
						N/A = 1
Source Dev Perf/Env Test						
Afocal	2		FOV Position	unknown		D
Afocal	2		Focus Position	unknown		D
SGCEU	1	EMI Filter	short	Revised vendor drawing to change packaging for better heat sink		D
SEU	1	EMI Filter	short	Revised vendor drawing to change packaging for better heat sink		D

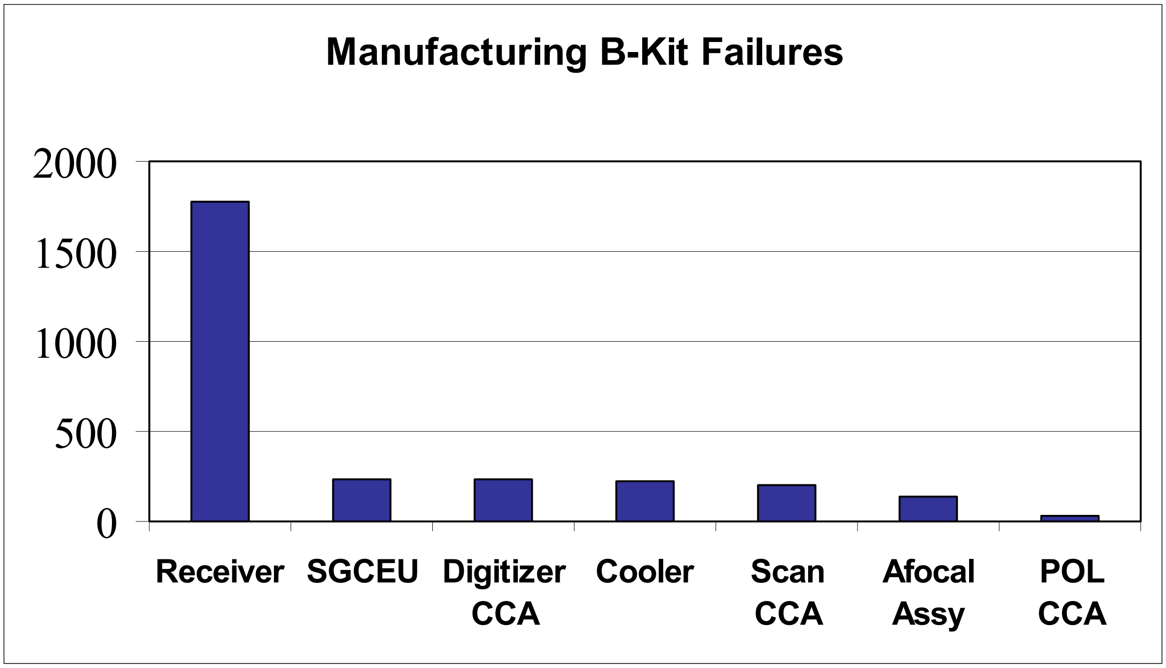
Video Converter CCA	1	Q2 FET	short	redesigned CCA to improve FET protections		D
Az Drive	1	Az Lock Assy	Az lock Assy misaligned	Revise assembly Instructions		W
Afocal and Receiver	1		fails Atherm, doesn't hold perfect focus over 20C change.	Revise software coefficients		D&W
SEU	1	SIF	EMI on control loop	relayout CCA to lessen EMI impact		D
Az Drive	1	Az Lock Assy	Az lock Assy misaligned	Revise assembly Instructions	Y	W
Afocal	1	Lens Assy	potting and position of lenses failed FOV at temperature	none	Y	D &W
Afocal	1	FOV Switch Mechanism	metal on metal during FOV switch fails Audible noise limits	none	Y	D&W
Receiver	1	Filter Wheel Assy	metal on metal during filter switch fails Audible noise limits	none	Y	D&W
Total	14				Total Y = 4	Total W=6
					Most N/A because too recent in test	D= 12
OMNI DVT Perf/Env						
Afocal	3		Failed to focus at cold temperatures	Reset photo diode set point		D

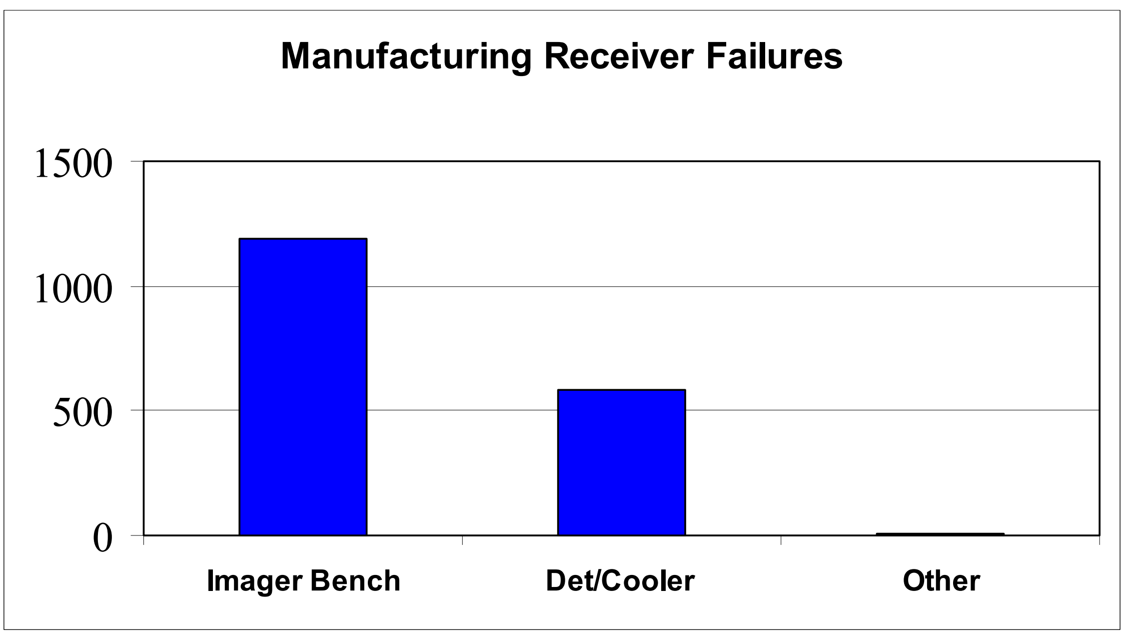
Afocal	2		Failed to focus during and after vibration	reset and torqued bearings, designed metal piece to prevent movement		D
Afocal	1		Shook loose from test tube	Revised Assembly Instructions		W
Afocal	1		FOV Switch mechanism	Reset switch mechanism position to drive mechanism further into stop		D
Afocal	1		FOV Switch mechanism	drive screw-shaft was about 0.006" loose. Strengthened preload crescent washer, added shim.		D
Total	8					Total W = 1
						D = 7

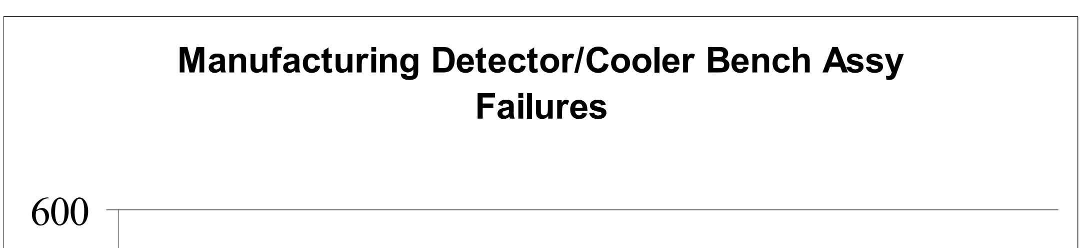
APPENDIX C

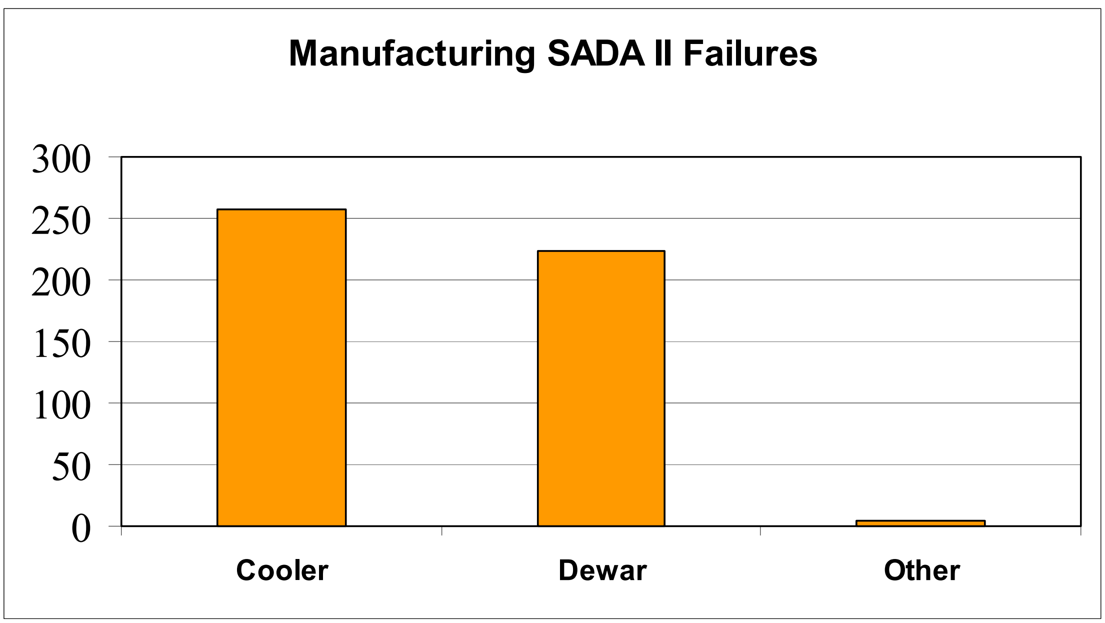
Analyses of B-Kit Manufacturing Failure Data

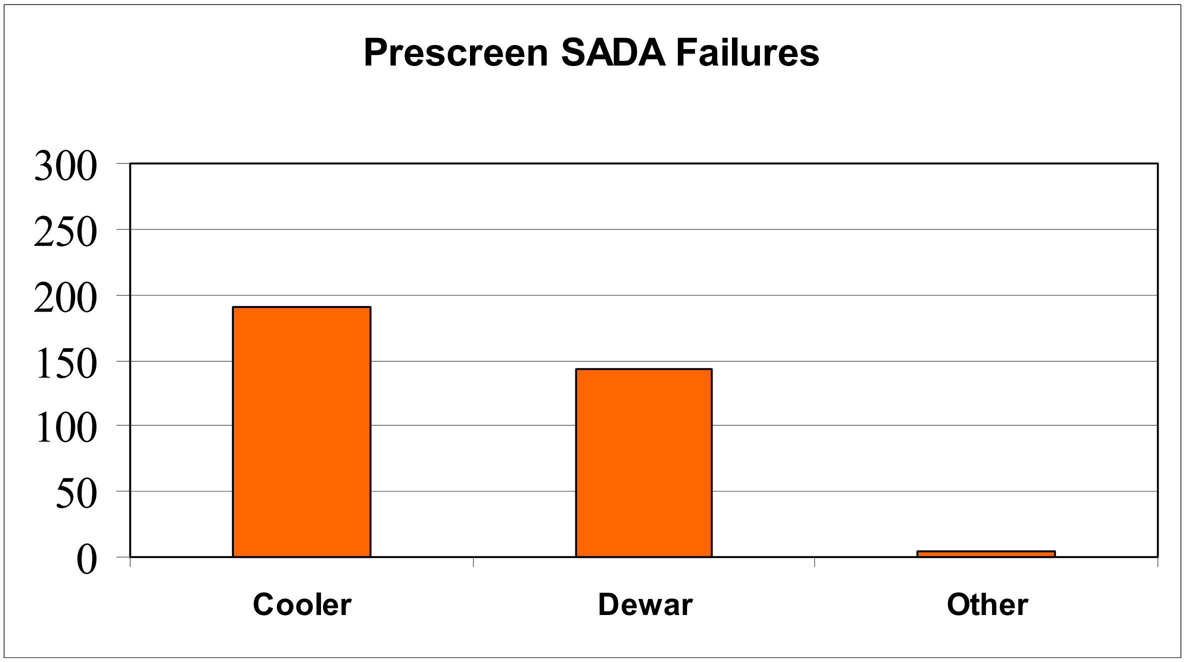
Figures

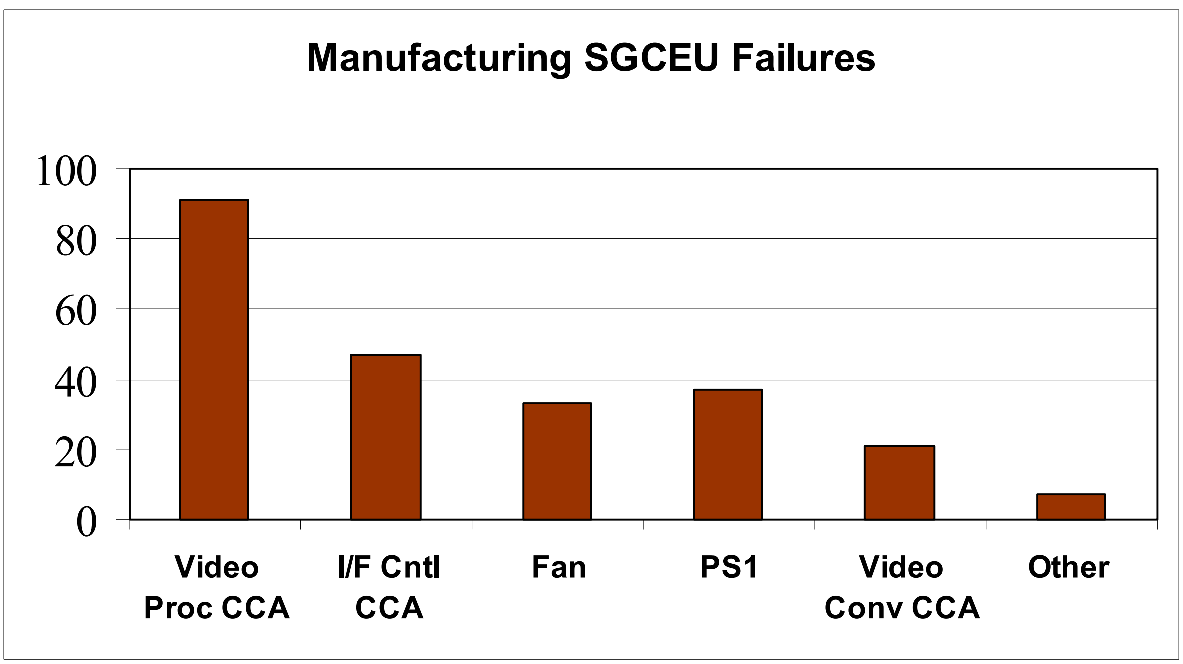

Manufacturing B-Kit Failures
2000
1500
1000
500
0
Receiver
SGCEU
Digitizer CCA
Cooler
Scan CCA
Afocal Assy
POL CCA

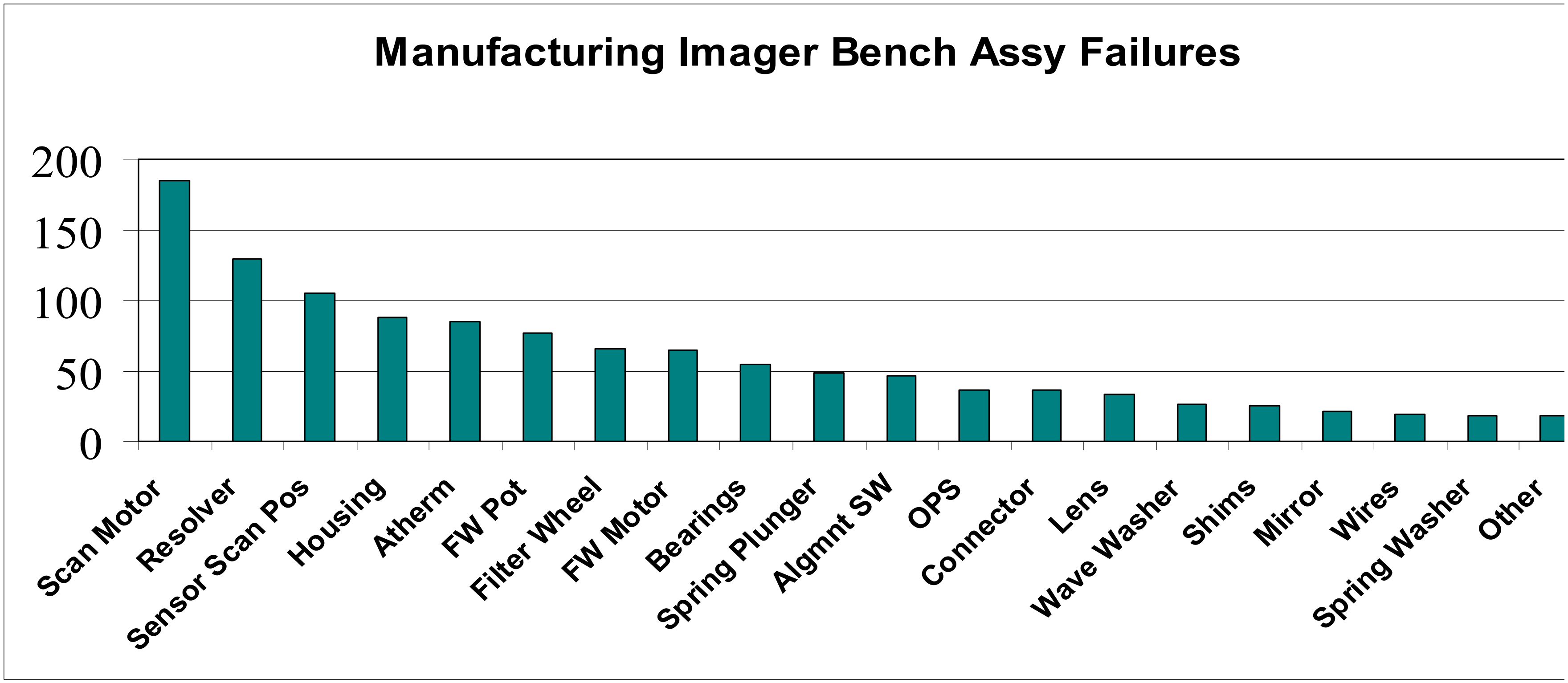

Manufacturing Receiver Failures
1500
1000
500
0
Imager Bench
Det/Cooler
Other


Manufacturing Detector/Cooler Bench Assy Failures
600


Manufacturing SADA II Failures
300
250
200
150
100
50
0
Cooler
Dewar
Other


Prescreen SADA Failures
300
250
200
150
100
50
0
Cooler
Dewar
Other


Manufacturing SGCEU Failures
100
80
60
40
20
0
Video Proc CCA
I/F Cntl CCA
Fan
PS1
Video Conv CCA
Other


Manufacturing Imager Bench Assy Failures
200
150
100
50
0
Scan Motor
Resolver
Sensor Scan Pos
Housing
Atherm
FW Pot
Filter Wheel
FW Motor
Bearings
Spring Plunger
Algmnt SW
OPS
Connector
Lens
Wave Washer
Shims
Mirror
Wires
Spring Washer
Other

Manufacturing Failure Data

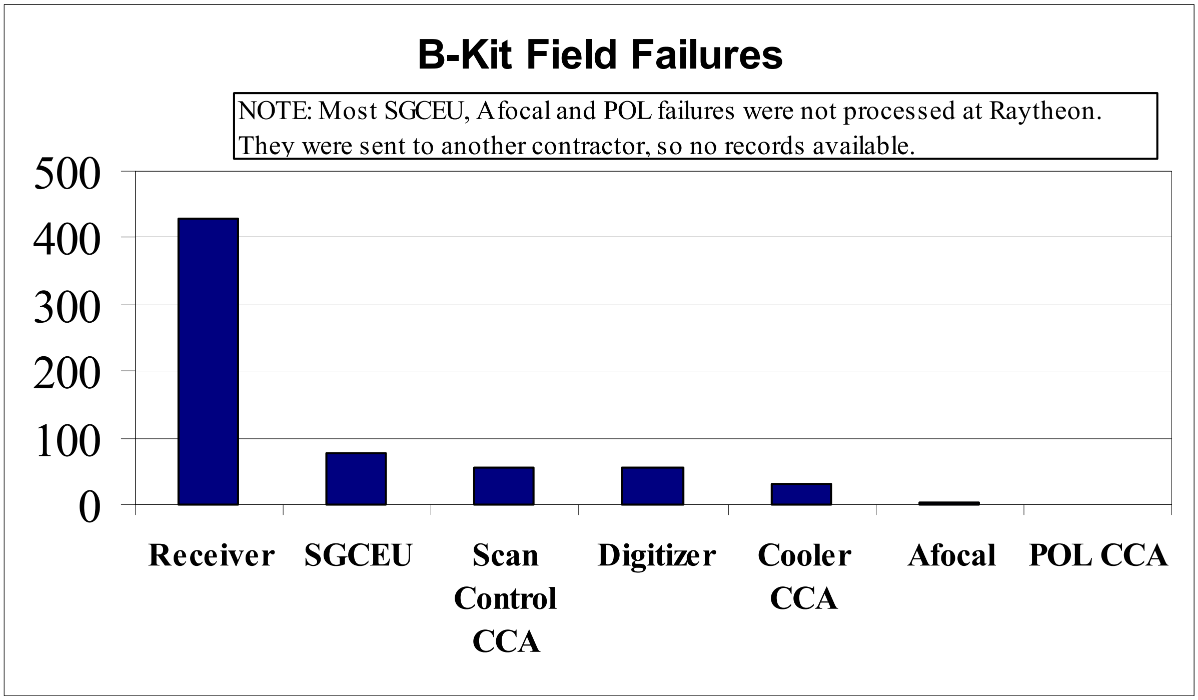
Data File is Too Large to Include in this Appendix (440 pages).
For Manufacturing Failure Data Information for the NV-80 B-Kit, Contact:

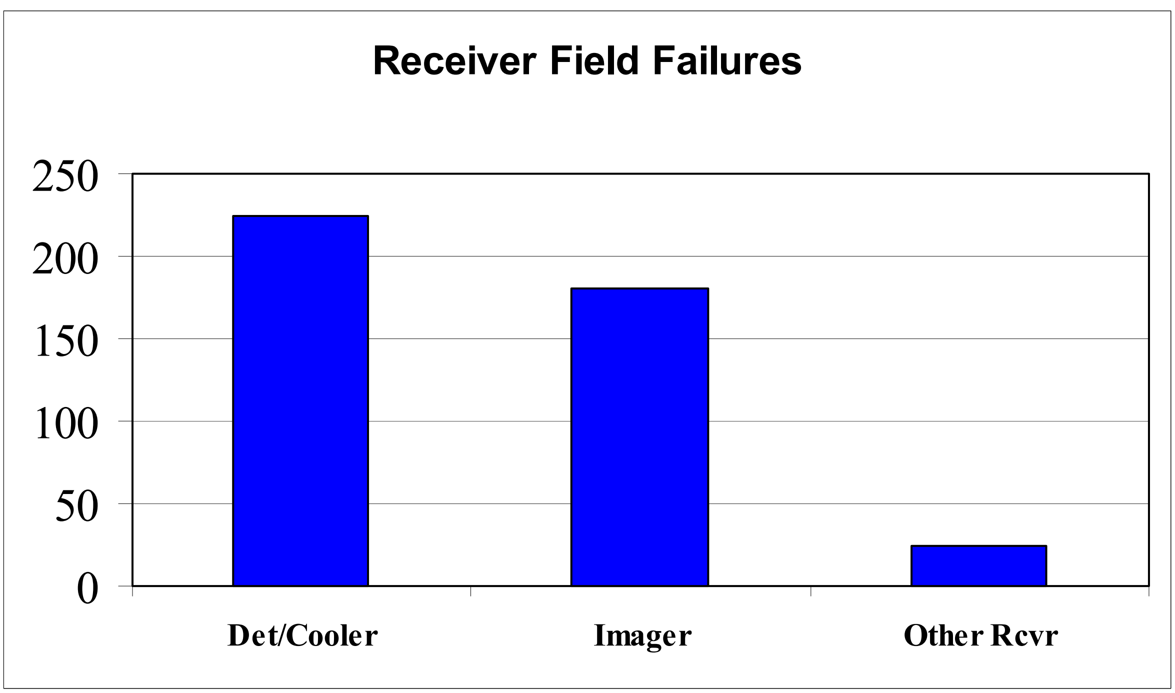
HTI NV-80 B-Kit Program
2501 W. University, MS 8096
Raytheon Company
McKinney, TX 75071
or
jeanc@raytheon.com

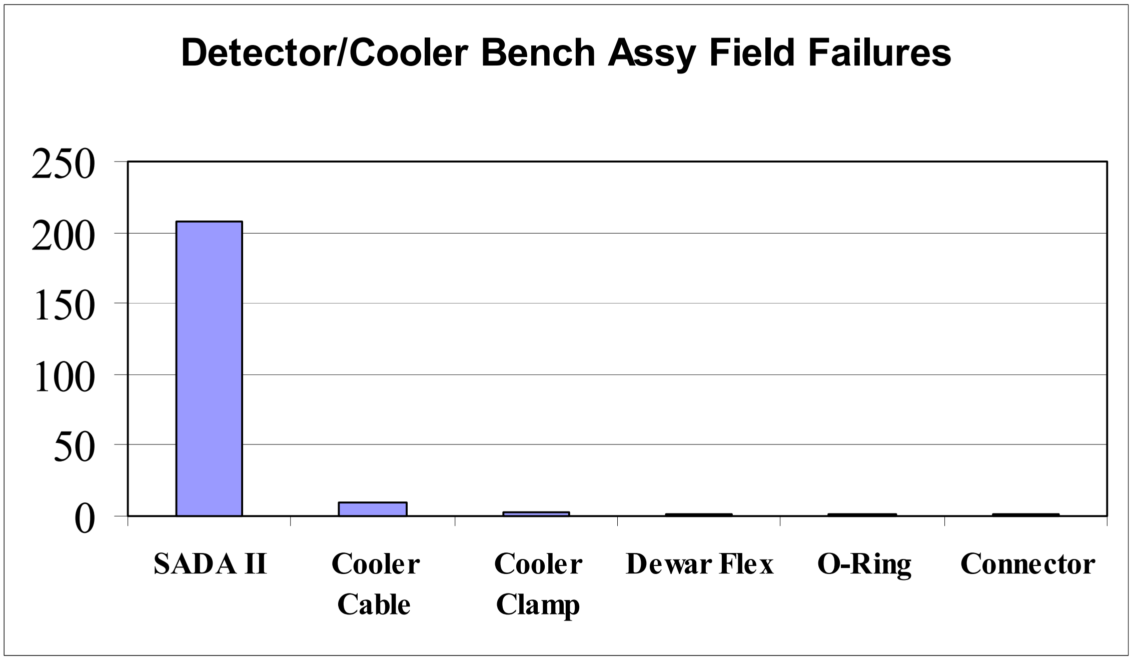
APPENDIX D

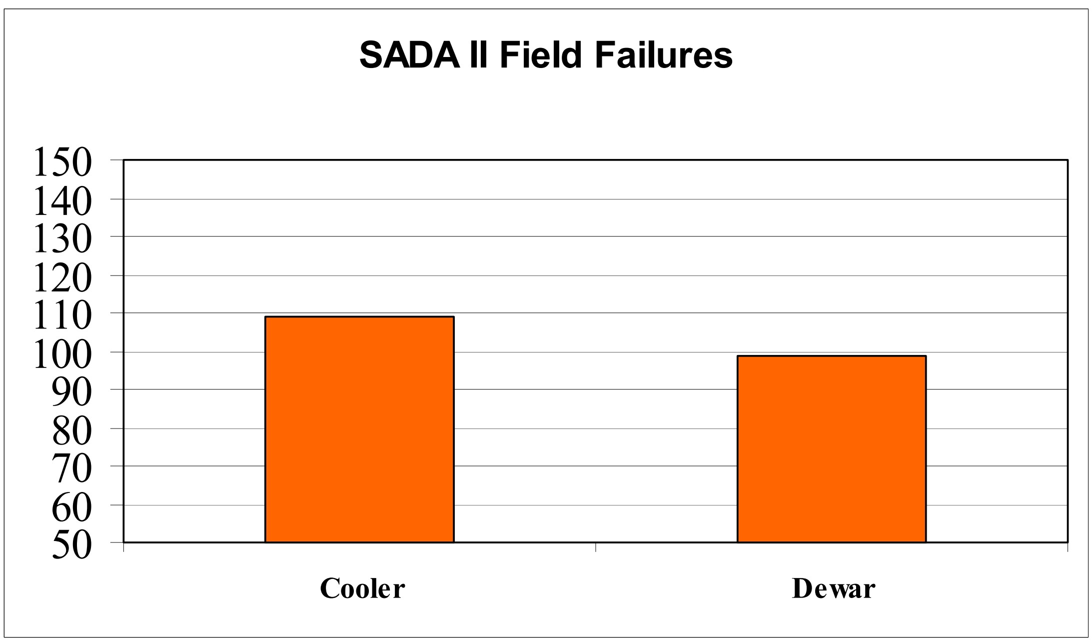
Analyses of B-Kit Field Failure Data

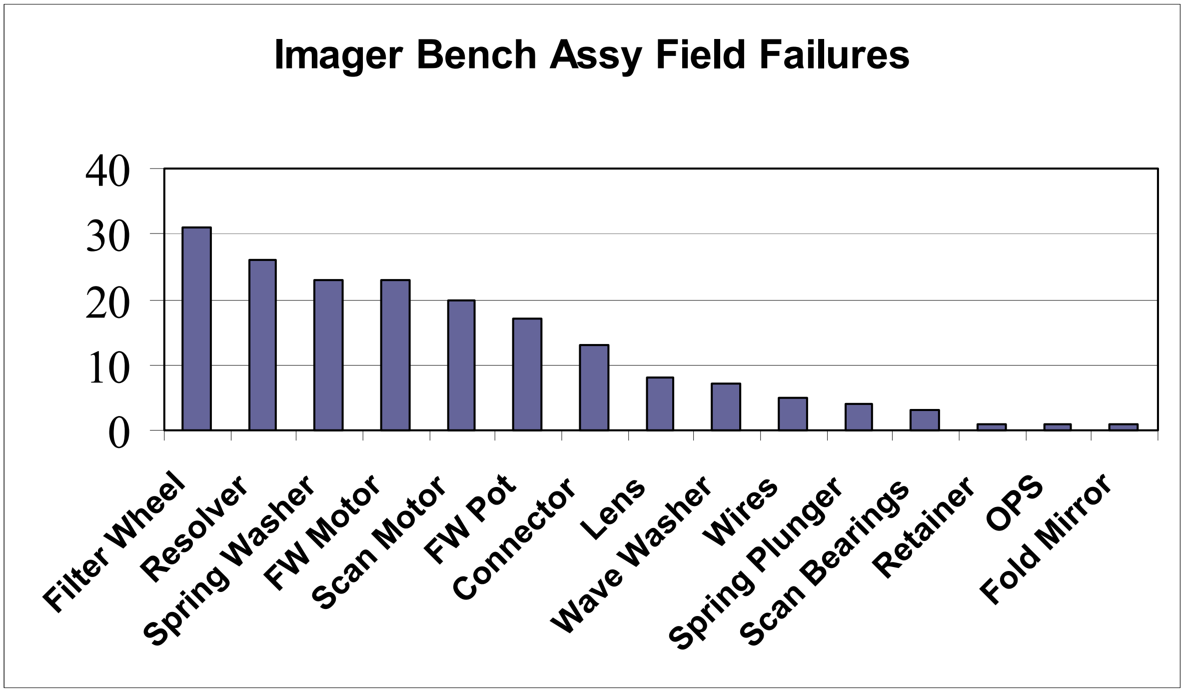
FIGURES


B-Kit Field Failures
NOTE: Most SGCEU, Afocal and POL failures were not processed at Raytheon. They were sent to another contractor, so no records available.
500
400
300
200
100
0
Receiver
SGCEU
Scan Control CCA
Digitizer
Cooler CCA
Afocal
POL CCA


Receiver Field Failures
250
200
150
100
50
0
Det/Cooler
Imager
Other Rcvr


Detector/Cooler Bench Assy Field Failures
250
200
150
100
50
0
SADA II
Cooler Cable
Cooler Clamp
Dewar Flex
O-Ring
Connector


SADA II Field Failures
150
140
130
120
110
100
90
80
70
60
50
Cooler
Dewar


Imager Bench Assy Field Failures
40
30
20
10
0
Filter Wheel
Resolver
Spring Washer
FW Motor
Scan Motor
FW Pot
Connector
Lens
Wave Washer
Wires
Spring Plunger
Scan Bearings
Retainer
OPS
Fold Mirror

Field Failure Data

ITEM	Initial Complaint	FAILDESCRIPTION	CLOSE_DATE	Lowest Failed Component	Next Higher Assy	Highest Assy
CW3263967-1	Failed being used as a slave Golden unit. Power surge, video flickered, then no image	Failed at ambient being used as a slave Golden unit. Power surge, video flickered, then no image.	11/16/2001	IC, Digital, Tranceiver	Video Proc CCA	SGCEU
C3222300-0001	replace U39 pn 3222313-1.rwp9612			INTEGRATED CIRCUIT (	Video Proc CCA	SGCEU
C3222300-0001	replace U30 pn 3224133-1.rwp9612			IC, PAL, 22V10	Video Proc CCA	SGCEU
CW3263967-1	Fails TRS Sums/VP vertical direction + VP1 control signature @60 C. CND in PSA @70C			Video Processor CCA, SMT	Video Proc CCA	SGCEU
CW3263967-1	Fails turn-on word 3=1 Globalization/Polarity.	Fails turn-on word 3=1 (s.b. 0), Globalization/ Polarity.	09/25/2001	Video Processor CCA, SMT	Video Proc CCA	SGCEU
CR3222300-1	Hangs up in grayscale @ turn-on.			Video Proc CCA	Video Proc CCA	SGCEU

CR3222300-1	Hangs up in grayscale @ turn-on.			Video Proc CCA	Video Proc CCA	SGCEU
CR3222300-1	FAILED DSETS			Video Proc CCA	Video Proc CCA	SGCEU
CR3222300-1	No FLIR picture would not perform TRU BIT tested bad on hotmock-up			Video Proc CCA	Video Proc CCA	SGCEU
CR3222300-1	No cust. comp		04/17/2002	Video Proc CCA	Video Proc CCA	SGCEU
CR3222300-1	FAILED DSETS		04/17/2002	Video Proc CCA	Video Proc CCA	SGCEU
CW3263967-1	Failed DSETS	No reticle in 50x, 25x, and 13x positions. Failed DESETS, fault ID 25470.	04/17/2002	Video Proc CCA	Video Proc CCA	SGCEU
CW3263967-1	Fails Globalization/VP vertical direction when being used as slave @ ambient. Pin in card is broken from out of package.	1. Fails Globalization/ VP vertical direction when being used as slave @ ambient. 2. Pin in card guide is broken from out of	09/25/2001	Video Proc CCA	Video Proc CCA	SGCEU

		package.				
CW3263967-1	Fails thermal Hot +60c for comm. failure.			Video Proc CCA	Video Proc CCA	SGCEU
CW3263967-1	TRS SUMS/ VP VERTICAL DIRECTION, VP1 CONTROL SIGNATURE.	TRS Sums/ VP Vertical direction, VP1 Control Signature at +60 deg. C.		Video Proc CCA	Video Proc CCA	SGCEU
CW3263967-1	Failed vibe- SGCEU BUS A.		04/10/2002	Video Proc CCA	Video Proc CCA	SGCEU
CW3263967-1	GUIDE pin on connector 180 off placement.			Video Proc CCA	Video Proc CCA	SGCEU
CW3263967-1	Fails TRS SUMS/VP Vert Direction & VP1 control signal.		04/17/2002	Video Proc CCA	Video Proc CCA	SGCEU
CW3263967-1	Tested at +22C. Normal operation observed. CCA passed specs.			Video Proc CCA	Video Proc CCA	SGCEU

CW3263967-1	TRS Sums/VP Vertical direction VP1 control signature.			Video Proc CCA	Video Proc CCA	SGCEU
CW3222300-1	Unit failed to turn on, hangs up in gray scale	Unit failed to turn on, hangs up in gray scale	04/22/2002	LINEAR OP-AMP 041	Video Proc CCA	SGCEU
CW3263967-1	Removed VP no day T.V.	No day TV.	08/21/2001	IC,TTL to PECL	Video Proc CCA	SGCEU
CW3263967-1	Failed total power up. Static image, grayscale locked on & temp 0.0	Failed total power up. Static image, grayscale locked on & temp 0.0.	10/11/2001	IC, Robo Clock	Video Proc CCA	SGCEU
CW3222300-1	Fails word 3=1 Globalization/Polarity.	Fails word 3=1 (s.b. 0), Globalization/Polarity.		IC, PAL	Video Proc CCA	SGCEU
CW3222300-1	Unit fails 32 Globalization/Polarity and volt out N8a @ thermal -40c and 20.5 volts. Note: video was distorted	Unit fails 32 Globalization/ Polarity and volt out N8a @ thermal -40c and 20.5 volts. Note: video was distorted.	05/24/2002	IC, PAL	Video Proc CCA	SGCEU

CW3222300-1	Thermal cold: Globalization polarity,video sync EI and video distorted.	Thermal cold: Globalization polarity,video sync EI and video distorted.	11/19/2001	IC, FPGA, XC4013E-4PG223M	Video Proc CCA	SGCEU
CW3222300-1	Fails Word 3=1 Globalization/Polarity			IC, FPGA, XC4013E-4PG223M	Video Proc CCA	SGCEU
CW3222300-1	Fails Globalization/Polarity @ -40c	Fails Globalization/Polarity @ -40C.		IC, FPGA, XC4013E-4PG223M	Video Proc CCA	SGCEU
CW3263967-1	Failed BIT Globalization/Polarity, TRS Sums, VP vertical direction VP1 control signal.	Failed BIT Globalization/ Polarity, TRS Sums, VP vertical direction, VP1 control signal @ ambient.	08/27/2002	IC, Digital, Translator	Video Proc CCA	SGCEU
CW3263967-1	Fails BIT Globalization/Polarity	Fails BIT Globalization/ Polarity	08/27/2002	IC, Digital, Translator	Video Proc CCA	SGCEU
CW3263967-1	Fails total power + static test pattern video.			IC, Digital, Translator	Video Proc CCA	SGCEU
CW3263967-1	Fails BIT Globalization/Polarity.	Fails BIT: Globalization/ polarity, TRS sums, VP vertical direction, VP1	08/27/2002	IC, Digital, Translator	Video Proc CCA	SGCEU

		control sig.				
CW3263967-1	Fails 1553 comm. and cooldown @ -40c.			IC, Digital, Translator	Video Proc CCA	SGCEU
CW3263967-1	Fails 1553 comm. + cooldown @ thermal cold -40c.			IC, Digital, Translator	Video Proc CCA	SGCEU
CW3263967-1	Fails multiple BIT @-40C sometimes. No video. ID1 in (U45) seems intermittent. p/n 3222740-1 Hard to make fail			IC, Digital, Translator	Video Proc CCA	SGCEU
CW3263967-1	Fails turn-on word 3=301. Globalization/Polarity, TRS SUMS, VP VERT DIRECTION, VP1 CONTROL SIGNAL		08/27/2002	IC, Digital, Translator	Video Proc CCA	SGCEU

CW3263967-1	Fails BIT TRS Sums/VP vert. direction. Replaced PN 3222740-0001	Fails BIT: TRS Sums, VP vert. direction @ ambient.	08/27/2002	IC, Digital, Translator	Video Proc CCA	SGCEU
CW3263967-1	Fails BIT TRS Sums/VP vertical direction, VP1 control signal.	Fails BIT: TRS Sums, VP vertical direction, VP1 control signal @ ambient.	08/27/2002	IC, Digital, Translator	Video Proc CCA	SGCEU
CW3263967-1	Fails BIT TRS Sums/VP vert direction, VP1 control signal.	Fails BIT: TRS Sums, VP vert direction, VP1 control signal @ ambient.	08/27/2002	IC, Digital, Translator	Video Proc CCA	SGCEU
CW3263967-1	System locks up in BIT			IC, Digital, Translator	Video Proc CCA	SGCEU
CW3263967-1	No Cust. Comp	Fails System Bus Tests 1 & 2.	06/12/2002	IC, Digital, Translator	Video Proc CCA	SGCEU
CW3263967-1	Video flashes @ Hot.			IC, Digital, Translator	Video Proc CCA	SGCEU
CW3263967-1	1553 COMM. Failure			IC, Digital, Translator	Video Proc CCA	SGCEU
CW3263967-1	Globalization/Polarity, VP1 Control Signature, TRS SUMS/VP Direction, SADA			IC, Digital, Translator	Video Proc CCA	SGCEU

	Bad Channels.					
CW3263967-1	NO VIDEO	No video.	06/11/2002	IC, Digital, Tranceiver	Video Proc CCA	SGCEU
CW3263967-1	No Video	No video.	06/11/2002	IC, Digital, Tranceiver	Video Proc CCA	SGCEU
CW3263967-1	Would not go into BIT mode and BICU display lit with knob in off position during test at HMUIT.	Would not go into BIT mode and BICU display lit with knob in off position during test at HMUIT.		IC, Digital, Tranceiver	Video Proc CCA	SGCEU
CW3222300-1	Fails Word 3=1 Globalization/Polarity	Fails Word 3=1 Globalization/Polarity		IC, Digital, ABT8245	Video Proc CCA	SGCEU
CW3222300-1	Globalization Polarity			IC FIFO 16K X 9	Video Proc CCA	SGCEU
CW3222300-1	Replace, rwp9612, because fail was at -46c.		05/24/2002	IC FIFO 16K X 9	Video Proc CCA	SGCEU
CW3222300-1	Replace, rwp9612, because fail was at -46c.		05/24/2002	IC FIFO 16K X 9	Video Proc CCA	SGCEU

CR3222300-1	No reticle in 50x, 25x, and 13x positions. Failed DESETS, fault ID 25470.			IC ASIC CF99015GB	Video Proc CCA	SGCEU
CW3263967-1	No cust. comp	P1-70 pin broken off.		CONNECTOR, PWB CO	Video Proc CCA	SGCEU
CW3263967-1	Globalization Polarity			Video Proc CCA	Video Proc CCA	SGCEU
CW3222300-1	Unit had distorted video BIT failure.	Unit had distorted video. BIT failure.		IC, PECL to TTL	Video Proc CCA	SGCEU
CW3222300-1	EU failed for no video.	EU failed for no video because the unit was dropped in the field.	05/10/2001	IC, Digital, ABT8245	Video Proc CCA	SGCEU
CW3222300-1	Video was flickering	Video was flickering.		IC, Digital, ABT8245	Video Proc CCA	SGCEU
CW3240063-2	13x will not focus.			User Error	User	User
CW3222300-1	CCA causes TRU to fail bit TRU status, TIS status, globalization polarity, 2d filter, TRS SUMS, VP vertical directions.			Video Proc CCA	SGCEU	SGCEU
CW3222300-1	NO CUST COMPLAINT	No FIAR.		Video Proc CCA	SGCEU	SGCEU

CW3222300-1	GLOBALIZATION POLARITY at +60 deg. C.			Video Proc CCA	SGCEU	SGCEU
CW3222300-1	Flickering & video breakup @ 60c "intermittent".	Flickering & video breakup @ 60C "intermittent".		Video Proc CCA	SGCEU	SGCEU
CW3222300-1	Fails Globalization polarity, @ cold -40c.	Fails Globalization polarity, @ cold -40c.		Video Proc CCA	SGCEU	SGCEU
CW3222300-1	Globalization Polarity			Video Proc CCA	SGCEU	SGCEU
CW3222300-1	in for global/pol BIT @-40, fails TRS sums instead Replaced parts (p/n3217413-1) have ugly outputs at pin 15			Video Proc CCA	SGCEU	SGCEU
CW3222288-1	CCA causes TRU to fail BIT TRU status, TIS status, Globalization/Polarity, 2D filter, TRS sums, VP vertical			Video Proc CCA	SGCEU	SGCEU

CW3222300-1	Tested EU at +23C & -40C. At -40C, bit fail occurred, word 5=1; Fail Globalization/Polarity.Video has flashing horizontal lines.			Video Proc CCA	SGCEU	SGCEU
CW3222300-1	No video. no reticle. no +/-15vdc no +/-8vdc		06/17/2002	Video Proc CCA	SGCEU	SGCEU
CW3222300-1	Video bands-no images just horizontal stripes of various widths.			Video Proc CCA	SGCEU	SGCEU
CW3222300-1	Globalization Polarity, TRS SUMS/VP Direction VP Control Signature.			Video Proc CCA	SGCEU	SGCEU
CR3240053-1	No cust. comp.			SGCEU	SGCEU	SGCEU
CW3222280-1	Fails Input Power Word 5 Scan Position Limits.	Failed Input Power Word 5 Scan Position Limits.	03/22/2001	SGCEU	SGCEU	SGCEU
CW3222280-1	Fails UT Input Power Word 5 Scan Position Limit.	Failed Input Power Word 5 Scan Position Limits.	03/22/2001	SGCEU	SGCEU	SGCEU

CW3222280-1	Fails BIT Scanner Position Limits (Took 20 min. to cooldown and failed BIT cooldown monitor; DRS chgd cooler CCAs and rcvr then passed cooldown but failed BIT for Scanner Position Limits.)	Failed BIT Scanner Position Limits.	03/22/2001	SGCEU	SGCEU	SGCEU
CW3222300-1	Fails 40 TRS SUMS/VP vertical directions.	Fails TRS SUMS/VP vertical directions.		SGCEU	SGCEU	SGCEU
CW3222304-2	Pin 55 broken	Pin 55 broken.	08/07/2001	CE/FI JUMPER	SGCEU	SGCEU
CW3222300-1	Global/Pol BIT @-40C in IBAS/30HZ mode. U25-13 stuck high. p/n 3222313-1 (Deskew FIFO)			Video Proc CCA	SGCEU	SGCEU
CW3222300-1	Fails Word 3=10 Globalization/Polarity, TRS Sums/VP Vert			Video Proc CCA	SCCEU	SGCEU

	Direction					
CR3222292-1	Unit powered up in reverse visible damage to board.			User Error	Scan CCA	Scan CCA
CR3222292-1	FAILED DESETS	fails incoming CRC checks reads 0x4055dfa.	02/25/2002	Software Load	Scan CCA	Scan CCA
CR3222292-1	Failed DESETS	Fails incoming test CRC cks - reads 0X4055DFA.	02/25/2002	Software Load	Scan CCA	Scan CCA
CR3222292-1	NO CUST COMPLAINT			Software Load	Scan CCA	Scan CCA
CR3222292-1	Failed DESETS		02/25/2002	Software Load	Scan CCA	Scan CCA
CR3222292-1	NO CUST. COMP			Software Load	Scan CCA	Scan CCA
CW3222292-1	FAILS DESETS	Fails DSESTS.	02/25/2002	Software Load	Scan CCA	Scan CCA
CW3222292-1	NO FIAR	NO FIAR	02/25/2002	Software Load	Scan CCA	Scan CCA

CW3222292-1	FAILS DESETS	FAILS DESETS	02/25/2002	Software Load	Scan CCA	Scan CCA
CW3222292-1	Failed DESETS.			Software Load	Scan CCA	Scan CCA
CW3222292-1	No FIAR	No failure symptoms.		Software Load	Scan CCA	Scan CCA
CW3222292-1	FAILS DESETS	FAILS DESETS	02/25/2002	Software Load	Scan CCA	Scan CCA
C3263964-0001	U39 and U40 shorted VCC to GND, Recommending replacing		05/13/2002	SEMICONDUCTOR	Scan CCA	Scan CCA
CW3263964-1	Fails static test pattern/ low total power @ 1st test ambient.		12/13/2001	Scan Control CCA	Scan CCA	Scan CCA

CW3263964-1	TRU fails BIT test and power up during thermal due to using dry air from a compressor instead of nitrogen p/p calls for nitrogen. This formed condensation in the chamber. TRU is not a sealed unit	DRS TRU 388 failed BIT test & power up during thermal (cold) due to using dry air from a compressor instead of nitrogen. P/P (sic) calls for nitrogen. This formed condensation in the chamber. TRU is not a sealed unit.	02/01/2002	Scan Control CCA	Scan Control CCA	Scan Control CCA
CW3263964-1	Secondary fail caused by CIV cell SAU test station's failed SGCEU (room temp failure).	Secondary fail caused by CIV cell SAU test station's failed SGCEU (room temp failure).	10/12/2001	Scan Control CCA	Scan Control CCA	Scan Control CCA
CW3263964-1	Secondary fail caused by CIV cell SAU test station's failed SGCEU (room temp failure).	Secondary fail caused by CIV cell SAU test station's failed SGCEU (room temp failure).	10/12/2001	Scan Control CCA	Scan Control CCA	Scan Control CCA

CR3263964-1	No Cust. Comp			Scan Control CCA	Scan Control CCA	Scan Control CCA
CR3222292-1	NO FIAR			Scan CCA	Scan CCA	Scan CCA
CW3222292-1	Causes scan jitter.	Causes scan jitter @ ambient.	08/28/2001	Scan CCA	Scan CCA	Scan CCA
CW3222292-1	CCA causes EU-TO-SU serial link BIT failure @ hot and cold temperature test	Scan Control CCA		Scan CCA	Scan CCA	Scan CCA
CR3222292-1	CCA causes EU-TO-SU Serial link BIT failure @ hot and cold temperature test	Scan Control CCA		Scan CCA	Scan CCA	Scan CCA
CW3222292-1	CCA suspect caused intermittent Flir failures during qualification testing	CCA suspect, caused intermittent FLIR failures during qualification testing.	08/28/2001	Scan CCA	Scan CCA	Scan CCA
CR1916939-1	System lock up during power-up. Possible software corruption	System lock up during power-up. Possible software corruption troubleshot by Tom Heath.		Scan CCA	Scan CCA	Scan CCA

CR3222292-1	Will not power-up.			Scan CCA	Scan CCA	Scan CCA
CW3222292-1	Causes scanner flutter	Causes scanner flutter.	08/28/2001	Scan CCA	Scan CCA	Scan CCA
CW3263964-1	Ejector broke			Scan CCA	Scan CCA	Scan CCA
CW3263964-1	Failed thermal @ all temps BIT doesn't complete on AT station fails scan error, flir fail, scanner position limits scanner			Scan CCA	Scan CCA	Scan CCA
CW3263964-1	FAILS BIT WORD 5=4000 (SCANNER POSITION LIMITS)		08/12/2002	Scan CCA	Scan CCA	Scan CCA
CW3263964-1	Failed scan error and scan position limits @ vibe.	Failed scan error and scan position limits @ vib.		Scan CCA	Scan CCA	Scan CCA
CW3263964-1	No FIAR	Did not run BIT as commanded 10 times.	07/24/2001	Scan CCA	Scan CCA	Scan CCA
CW3263964-1	Failed laser pulse range mismatch.	Failed laser pulse range mismatch. Bkit fail, Cooler Input	03/18/2002	Scan CCA	Scan CCA	Scan CCA

		power.				
CW3263964-1	Failed vib test i-bit hti b-kit, sgceu bus a moving fov current and eu/su serial timeout, fov position test.	Failed vib test i-bit hti b-kit, sgceu bus a, moving fov current and eu/su serial timeout, fov position test.		Scan CCA	Scan CCA	Scan CCA
CW3263964-1	Scan control cca locks up in P-BIT.		07/09/2002	Scan CCA	Scan CCA	Scan CCA
CW3263964-1	Locked up with test pattern image and would not cooldown, failed total power @ 1st test.	Locked up with test pattern image and would not cooldown; failed total power @ 1st test.	12/13/2001	Scan CCA	Scan CCA	Scan CCA
CW3263964-1	Board width dimension is 5.920 +- .010. Checks 5.948 will not fit in TAS.	Board width dimension is 5.920 +- .010. Checks 5.948 will not fit in TAS.	08/07/2001	Scan CCA	Scan CCA	Scan CCA
CW3263964-1	Fails sys u.t. for jittery video.			Scan CCA	Scan CCA	Scan CCA

	jittery video.					
CW3263964-1	Fails EU/SU serial leak check @ hot 60c.			Scan CCA	Scan CCA	Scan CCA
CW3263964-1	Focus shifts on its own and reticle seems to move at a snail pace.		05/13/2002	Scan CCA	Scan CCA	Scan CCA
CW3263964-1	FLIR fail -POL fails.	FLIR fail -POL fails, 5 and 12 P and N.	02/18/2002	OSCILLATOR; CRYSTAL	Scan CCA	Scan CCA
CW3263964-1	SBIT/BBIT/NBIT SAU, BKIT SU FAIL.			OSCILLATOR; CRYSTAL	Scan CCA	Scan CCA
CW3263964-1	Distorted video, background has checkered pattern.			MICROCIRCUIT	Scan CCA	Scan CCA
CW3263964-1	Will not power-up		05/13/2002	MICROCIRCUIT	Scan CCA	Scan CCA
CW3263964-1	Fails video sync A,D,F + scanner resolver execution @ thermal hot 60c.	Fails video sync A,D,F + scanner resolver execution @ thermal hot 60C.	02/18/2002	IC, Quad op amp, OP471GS	Scan CCA	Scan CCA
CW3263964-1	FLIR fail + locks up in BIT			IC, Quad op amp, OP471GS	Scan CCA	Scan CCA

CW3263964-1	FLIR fails + locks up in BIT			IC, Quad op amp, OP471GS	Scan CCA	Scan CCA
CW3263964-1	Flir fail during Self Survey-B/S achieved fail.			IC, Quad op amp, OP471GS	Scan CCA	Scan CCA
CW3222292-1	NO FIAR	NO FIAR	05/15/2002	IC, Linear 471	Scan CCA	Scan CCA
CR3222292-1	FM 30HZ INTERRUPT MCS TO BKIT 1553 CCD FILTERWHEEL OPERATION +32c AND -52c	FM 30HZ INTERRUPT MCS TO BKIT 1553 CCD FILTERWHEEL OPERATION +32c AND -52c.	05/15/2002	IC EEPROM 128KX32	Scan CCA	Scan CCA
CR3222292-1	Unit powered up in reverse visable damage to board.			IC EEPROM 128KX32	Scan CCA	Scan CCA
CW3222292-1	Scan does not allow completion of initialization.	Scan does not allow completion of initialization.		IC ANALOG SWITCH	Scan CCA	Scan CCA
CR3222292-1	FAILED DESETS			Connector, 110 pin	Scan CCA	Scan CCA
C3222292-0001	replace L5 pn 533616-52		05/15/2002	COIL	Scan CCA	Scan CCA

CR3222292-1	Failed DSETS	ncc, Fails POL mux control, resolver scan i\f volts, resolver cosine i\f volts, resolver sine i\f volts, resolver error i\f and scan motor peak drive current tests.	08/12/2002	COIL	Scan CCA	Scan CCA
C3240063-0002	IMAGE SHIFTS IN AZMITH	Causes image to shift back & forth in Azimuth (image shifts over to left, has blanking like a timing problem. In CCA test, failed OPS peak signal output control test. Failed embedded software; CRC reads 0xedd8e10.		CAPACITOR	Scan CCA	Scan CCA
C3263964-0001	reflow U100-10, reads 4.3m to pad		04/29/2002	(RPL)RESISTOR	Scan CCA	Scan CCA

CW3222292-1	A cap on the back side of the cca near pin 1 of connector is cracked. Chip that is installed on the socket is not coated.	Removed from TAS 1040, LTAS 1054 due to loss of FLIR video during IBAS vib. CBIT indicated: PS1 overvoltage & overcurrent, EU 2 SU serial link time out and numerous other faults. Vib was perpendicular to the scan CCA. A cap on the back side of the cca near pin 1 of connector is cracked. Chip that is installed on the socket is not coated.	07/10/2001	(RPL)CAPACITOR	Scan CCA	Scan CCA
C3222280-0001	TRU/EU will not complete BIT TEST.	TRU/EU will not complete BIT TEST.	08/27/2002	System Software	Receiver Assembly	Receiver Assembly

CR3222280-1	Intermittent fail @ cold temp (-32c) no FLIR image-display shows "Flir Fail" message. Intermittent condition getting progressively worse over several days.	Intermittent fail @ cold temp (-32C); no FLIR image. Display shows "FLIR Fail" message. Intermittent condition getting progressively worse over several days.	05/29/2002	Receiver Assembly	Receiver Assembly	Receiver Assembly
CW3222280-1	Screw is stripped on P2 connector.			Receiver Assembly	Receiver Assembly	Receiver Assembly
CW3222280-1	Removed from TAS 3229468-1-1005 rcvr caused flir boresight achieved error.	Removed from TAS 3229468-1-1005; rcvr caused FLIR boresight achieved error.	07/30/2001	Receiver Assembly	Receiver Assembly	Receiver Assembly

CW3222280-1	Image "breaths" @ ambient room and @ cold. Scan mirror bearings noted to be rough. This rcvr was tested in 2 IBAS assy with the same error.	Image "breaths" @ ambient room and @ cold. Scan mirror bearings noted to be rough. This rcvr was tested in 2 IBAS assy with the same error.	07/23/2001	Receiver Assembly	Receiver Assembly	Receiver Assembly
CW3222280-1	Fails NFOV to WFOV alignment at 1st test ambient.	Fails NFOV to WFOV alignment at 1st test ambient.	09/18/2001	Receiver Assembly	Receiver Assembly	Receiver Assembly
CW3222280-1	4Bar target in NFOV 1x zoom is badly distorted.	4-Bar target in NFOV 1X zoom is badly distorted. Boresight fails W2=400 & W4=2.	05/29/2002	Receiver Assembly	Receiver Assembly	Receiver Assembly
CW3222280-1	Fails DESETS.			Receiver Assembly	Receiver Assembly	Receiver Assembly
CW3222280-1	Failed wide field of view (rotation el)	Failed wide field of view (rotation El)	09/13/2001	Receiver Assembly	Receiver Assembly	Receiver Assembly

CW3222280-1	Fails NFOV to WFOV alignment @ 1st test ambient.	Fails NFOV to WFOV alignment @ 1st test ambient.	09/18/2001	Receiver Assembly	Receiver Assembly	Receiver Assembly
CW3222280-1	Fails test #9, step 6 wide field of view (Rotation EL)	Fails test #9, step 6 wide field of view (Rotation EL). (LL=-10.500, UL=+10.500; measured 11.382 - 10.657.)		Receiver Assembly	Receiver Assembly	Receiver Assembly
CW3222280-1	Unit fails wide field of view (rotation el).	Unit fails wide field of view (rotation el).	09/13/2001	Receiver Assembly	Receiver Assembly	Receiver Assembly
CW3222280-1	Failed 1st test NFOV to WFOV alignment.	Failed 1st test NFOV to WFOV alignment @ ambient.	09/18/2001	Receiver Assembly	Receiver Assembly	Receiver Assembly
CW3222280-1	Failed negative crosstalk/signal inversion @ 1st test ambient.	Failed negative crosstalk/signal inversion @ 1st test ambient. Previous failure ref. DMR 18261.	12/12/2001	Receiver Assembly	Receiver Assembly	Receiver Assembly
CW3222280-1	NO CUST. COMP		04/17/2002	Receiver Assembly	Receiver Assembly	Receiver Assembly

C3240063-0002	SG CITV Sight Assy. # 51202 failed because of noisy line, also fails DSETS (wrong software).	Rel. contacted Raytheon FSR Frank Bates @ Lima Tank Plant. DSESTS indicated "wrong software" but probably because DSESTS software lagged the software in the sight per Frank. PEI supposed to update the test set software (no date). Mary Carrell contacted Frank; had alignment retention run 10 times. Rel had the sight run through vib and retested; still CND.	05/23/2000	Receiver Assembly	Receiver Assembly	Receiver Assembly

CW3222280-1	No FIAR	Massive dead channels @ top 1/4 of monitor, which also caused gunner's display failure.	04/16/2001	Receiver Assembly	Receiver Assembly	Receiver Assembly
CW3222280-1	TRS/Overheat	TRS1 Overheat @ -40C.	07/12/2001	Receiver Assembly	Receiver Assembly	Receiver Assembly
CW3222280-1	Band of flashing video in middle of screen (room temp SAU unit test).	Band of flashing video in middle of screen (room temp SAU unit test).		Receiver Assembly	Receiver Assembly	Receiver Assembly
CW3222280-1	Video breathing (pulsing). No s/w communication. No bit fails.		07/23/2001	Receiver Assembly	Receiver Assembly	Receiver Assembly
CW3222280-1	FLIR fail- locked up in BIT on 1st test ambient.	FLIR fail- locked up in BIT on 1st test ambient.	12/12/2001	Receiver Assembly	Receiver Assembly	Receiver Assembly
CW3222280-1	Fails time out would not complete after final test.		05/24/2002	Receiver Assembly	Receiver Assembly	Receiver Assembly
CW3222280-1	FLIR gau z axis vibe; lost flir video bkit bits- scan fail		08/16/2002	Receiver Assembly	Receiver Assembly	Receiver Assembly

	scan fail.					
CW3222280-1	Fails FOV rotation elevation @ 1st test ambient.			Receiver Assembly	Receiver Assembly	Receiver Assembly

C3222280-0001	Vehicle rolled over and damaged CIV system.	Rcvr returned due to accidental damage, but filter wheel had 4 damaged teeth; no way to know if this was caused by the accident. Replaced filter wheel, incorporated block change (rev N). Re-performed IEL, did imager test, aligned scan motor to 100 mV error (hi 2.30, lo 2.50). Changed bench shims from .013 to .020 (imager average = .025) and ran rcvr part A & B tests successfully .	12/15/2000	DMG	Receiver Assembly	Receiver Assembly

		Ran 1 cycle burn-in 12/3/00. Replaced cooler clamp 12/14/00. Ready to ship 12/15/00.				
CW3222280-1	Unit fails due to excessive noise during 30 & 60 hz scan mode.		04/03/2002	Wave washer	Imager Bench Assy	Receiver Assembly

CW3222280-1	No cust. comp	Fails jitter test & sawtooth in video.	04/03/2002	Wave washer	Imager Bench Assy	Receiver Assembly
CW3222280-1	NO CUST. COMP	Fails Imager jiter TIS right high and low @60z target. Jitter enough to see five bars instead of 4 bar.		Wave washer	Imager Bench Assy	Receiver Assembly
CR3222281-1	wave washer noisey			Spring washer	Imager Bench Assy	Receiver Assembly
CW3222280-1	NO CUST COMP	@ RM TEMP. NOISY IN 60 Hz & JITTER BUT STILL IN SPEC.		Spring washer	Imager Bench Assy	Receiver Assembly
CW3222280-1	Fails severe video jitter @ 1st test ambient.			Spring washer	Imager Bench Assy	Receiver Assembly
CW3222280-1	No Cust. Comp	ncc,Tis bars do vibrate outside the box. Sawtooth video @ 30Hz. video vibrate & noisy @ 60Hz. ut052102.		Spring washer	Imager Bench Assy	Receiver Assembly
CW3222280-1	Excessive zipper in all magnification and video has jitter.			Spring washer	Imager Bench Assy	Receiver Assembly
CW3222280-1	Sight fails AT, MRT in Stare 4 fails.*	Sight fails AT, MRT in Stare 4 fails.		Spring washer	Imager Bench Assy	Receiver Assembly

CW3222280-1	Scan jitter on left side of video and cooler knocks on power-up.			Spring washer	Imager Bench Assy	Receiver Assembly
CW3222280-1	No Cust. Comp	ncc, Severe vibation & noise @ 60Hz.		Spring washer	Imager Bench Assy	Receiver Assembly
CW3222280-1	Severe Video Jitter	Severe Video Jitter @ 1st test ambient.		Spring washer	Imager Bench Assy	Receiver Assembly
CW3222280-1	Loose washer on scan motor.			Spring washer	Imager Bench Assy	Receiver Assembly
CW3222280-1	No flir video present. Boresight failed w/ CBIT.			Spring washer	Imager Bench Assy	Receiver Assembly
CW3222280-1	Fail sada eeprom, sada serial I/O + dig. serial I/O. Failed in sight 177. Fail @ -32c @ turn-on only.		11/14/2001	Spring washer	Imager Bench Assy	Receiver Assembly
CW3222280-1	Failed u.t. visual defect too much sawtooth jitter. Verified w/HTI b-kit A.T.			Spring washer	Imager Bench Assy	Receiver Assembly
CW3222280-1	Fails sys ut for jittery video.			Spring washer	Imager Bench Assy	Receiver Assembly
CW3222280-1	Fails extreme/severe video jitter @ 1st			Spring washer	Imager Bench Assy	Receiver Assembly

	video jitter @ 1st test ambient.					
CW3222280-1	Excessive jitter on target.			Spring washer	Imager Bench Assy	Receiver Assembly
CW3222280-1	Side to side shifts in FLIR kws mode of video.			Spring washer	Imager Bench Assy	Receiver Assembly
CW3222280-1	TEST			Spring washer	Imager Bench Assy	Receiver Assembly
CW3222280-1	Fails for severe video jitter @ 1st test ambient.			Spring washer	Imager Bench Assy	Receiver Assembly
CR3222280-1	Unit has zipper in all magnification & jitter.			Spring washer	Imager Bench Assy	Receiver Assembly
CW3222280-1	Fails sys ut for video jitter.			Spring washer	Imager Bench Assy	Receiver Assembly
CW3222280-1	Unit has zipper and jitter in all magnification.			Spring washer	Imager Bench Assy	Receiver Assembly
CW3222280-1	video jitter so you cant see the 4 bar target			Spring washer	Imager Bench Assy	Receiver Assembly
CW3222280-1	FAILS SCAN ERROR, FOV POSITION,SCA NNER POSITION LIMITS (Z-AXIS VIBE FAIL).	Fails Scan Error, FOV Position, Scanner Position Limits (z-axis vib fail).	11/05/2001	Spring plunger	Imager Bench Assy	Receiver Assembly

C3222280-0001	OPS WILL NOT ALIGN inside on OPS circuit ther are two fine wires touching and one broke.	OPS will not align.	06/14/2002	Wires	Imager Bench Assy	Receiver Assembly
CW3222280-1	Fails boresight achieved SU fail.	Fails boresight achieved; SU fail.	06/14/2002	Wires	Imager Bench Assy	Receiver Assembly
CW3222280-1	Fails to achieve boresight @ 1st test ambient.		06/14/2002	Wires	Imager Bench Assy	Receiver Assembly
CW3222281-1	Fails OPS alignment . No response when adjusting Ops signal.	ncc, Fails OPS alignment. No respondes when adjusting Ops signal.	06/14/2002	Wires	Imager Bench Assy	Receiver Assembly
C3240063-0002	Intermittent Power-ups.	Intermittent Power-ups.	08/07/2001	Scan motor	Imager Bench Assy	Receiver Assembly
CR3222281-1	FAILED DESETS		02/26/2002	Scan motor	Imager Bench Assy	Receiver Assembly

CR3222281-1	Scan motor not aligning	Scan motor not aligning.	08/12/2002	Scan motor	Imager Bench Assy	Receiver Assembly
CR3222281-1	FAILED DESETS	Imager out of alignment at all steps. Resolver will not start.	02/26/2002	Scan motor	Imager Bench Assy	Receiver Assembly
CR3222281-1	LTAS failure, no sight picture in FLIR mode during unit set fielding. Troubleshooting revealed "scan error and broken FLIR picture on hot mock up.		07/23/2002	Scan motor	Imager Bench Assy	Receiver Assembly
CW3222280-1	SU fail and Scanner Position Limits.	SU fail and Scanner Position Limits.	04/23/2001	Scan motor	Imager Bench Assy	Receiver Assembly
CW3222280-1	Unit failed DESETS code #11296 (verify BIT results for cooler compressor sensor and overheat test).	Unit failed DESETS code #11296 (verify BIT results for cooler compressor sensor and overheat test).		Scan motor	Imager Bench Assy	Receiver Assembly

CW3222280-1	SIGNIFICANT VIDEO JITTER & SEVERE SAW TOOTH IMAGE.	Significant video jitter & severe sawtooth image.		Scan motor	Imager Bench Assy	Receiver Assembly
CW3222280-1	SEVERE VIDEO JITTER (PLUS NFOV TO WFOV ALIGNMENT EL)	Severe video jitter (plus NFOV to WFOV alignment EL).		Scan motor	Imager Bench Assy	Receiver Assembly
CW3222280-1	SEVERE VIDEO JITTER	Severe video jitter.		Scan motor	Imager Bench Assy	Receiver Assembly
CW3222280-1	No cust. comp		04/17/2002	Scan motor	Imager Bench Assy	Receiver Assembly
CW3222280-1	SEVERE VIDEO JITTER	Severe video jitter.	06/05/2002	Scan motor	Imager Bench Assy	Receiver Assembly
CW3222280-1	BKIT SU ERROR	Bkit SU error=Boresight achieved.	03/18/2002	Scan motor	Imager Bench Assy	Receiver Assembly
CW3222280-1	IBIT failed BKIT moving filter wheel voltage and BKIT filterwheel position.		06/20/2002	Scan motor	Imager Bench Assy	Receiver Assembly
CW3222280-1	Fails gau pre vibe @ z axis for flir video jitter.		04/03/2002	Scan motor	Imager Bench Assy	Receiver Assembly

CW3222280-1	Fails for severe video jitter.			Scan motor	Imager Bench Assy	Receiver Assembly
CR3222281-1	No response from resolver lwhen unit is powered up.		04/12/2002	Scan motor	Imager Bench Assy	Receiver Assembly
CR3222280-1	SEVERE VIDEO JITTER.	Severe video jitter in 1st test ambient.	06/05/2002	Scan motor	Imager Bench Assy	Receiver Assembly
CW3222280-1	Distorted, band of horizontal dots, in FLIR video. Ambient upper third of video.			Scan motor	Imager Bench Assy	Receiver Assembly
CW3222280-1	No cust. comp			Scan motor	Imager Bench Assy	Receiver Assembly
CW3240063-2	Blank screen		07/16/2002	Wires	Imager Bench Assy	Receiver Assembly
CW3222280-1	fail focus & resolution			RETAINER; ID; ATH	Imager Bench Assy	Receiver Assembly
C3222280-0001	Fails resolver alignment. Will not align properly.	Chained. Original entry as ESD40153.		Resolver	Imager Bench Assy	Receiver Assembly

C3222280-0001	No FLIR video	No FLIR video.	05/23/2000	Resolver	Imager Bench Assy	Receiver Assembly
C3222280-0001	FAILED 30HZ AND 60HZ SCAN MODE. NO SIGNAL IS PRESENT.	Failed 30Hz & 60Hz scan mode. No signal present.		Resolver	Imager Bench Assy	Receiver Assembly
CR3222281-1	Fails Resolver Algn in the hold position, Resolver won't hold.		05/13/2002	Resolver	Imager Bench Assy	Receiver Assembly
CR3222281-1	Black wire on Scan Resolver has damage insulation.		07/17/2002	Resolver	Imager Bench Assy	Receiver Assembly
CR3222281-1	Fails visual inspect, red wire on Resolver has damages insulatio		07/17/2002	Resolver	Imager Bench Assy	Receiver Assembly
CR3222281-1	FAILED DESETS.	FAIL CONTINUITY TEST		Resolver	Imager Bench Assy	Receiver Assembly
CR3222281-1	Failed DESETS	Failed DSESTS.	07/17/2002	Resolver	Imager Bench Assy	Receiver Assembly

CR3222281-1	No cust. comp	ncc, Failed imager wiring check @ pin 44 to 29 - resolver rotor open.		Resolver	Imager Bench Assy	Receiver Assembly
CW3222280-1	Fails BIT: scan error, boresight achieved, focus position, focus position limits.			Resolver	Imager Bench Assy	Receiver Assembly
CW3222280-1	Unit scan fine @ 30hz but when switch to 620hz unit stop sannning possible a partial broken wire		04/02/2002	Resolver	Imager Bench Assy	Receiver Assembly
CW3222280-1	fail scan error / boresight achieved, broken black (neg.)wire on resovler		07/17/2002	Resolver	Imager Bench Assy	Receiver Assembly
CW3222280-1	Cooler compressor temp. sensor boresight achieved, moving f/w and f/w position,scan error, stationary f/w voltage scanner	Cooler compressor temp. sensor boresight achieved, moving FW and FW position, scan error, stationary FW voltage	07/17/2002	Resolver	Imager Bench Assy	Receiver Assembly

		scanner receiver f/b.				
CW3222280-1	Failed by customer, bit failure was scan error and position limits.	BIT fail - scan error and position limits.	07/17/2002	Resolver	Imager Bench Assy	Receiver Assembly
CW3222280-1	FLIR & locks up in BIT	FLIR fail & locks up in BIT@ ambient.		Resolver	Imager Bench Assy	Receiver Assembly
CW3222280-1	SU fail, scan error, boresight achieved TRS2 overheat, scanner position.			Resolver	Imager Bench Assy	Receiver Assembly
CW3222280-1	FLIR FAIL, NO FLIR VIDEO TARGET, B-KIT FAIL, SCAN ERROR AND BORESIGHT ACHIEVED ERROR.	FLIR fail, no FLIR video target, B-kit fail, scan error and boresight achieved error.		Resolver	Imager Bench Assy	Receiver Assembly

CW3222280-1	Receiver was rejected for video IR jitter (scanner problem). Also RCVR had audible noise when in 60HZ mode.	Receiver was rejected for video IR jitter (scanner problem). Also had audible noise in 60 Hz mode.	11/16/2001	Resolver	Imager Bench Assy	Receiver Assembly
CW3222280-1	Scan motor noisy @ power-up.	Scan motor noisy @ power-up. During LRAS3 UT, rcvr was driving scan motor too hard causing a hard stop on scan motor.	06/05/2002	Resolver	Imager Bench Assy	Receiver Assembly
CW3222280-1	Fails PBIT for scan error, Boresight Achieved, and scan position limits (room temp SAU LRU unit test fail).	Fails PBIT for scan error, Boresight Achieved, and scan position limits (room temp SAU LRU unit test fail).		Resolver	Imager Bench Assy	Receiver Assembly
CR3222281-1	Fails for open at pins 42 To 28 snd 44 to 29 during continuity test.			Resolver	Imager Bench Assy	Receiver Assembly

CR3222281-1	Failed DESETS.	Reverse at 30HZ and 60HZ failed	07/17/2002	Resolver	Imager Bench Assy	Receiver Assembly
CW3222281-1	Binocular display displays the message "FLIR fail".		07/17/2002	Resolver	Imager Bench Assy	Receiver Assembly
CR3222280-1	No cust. comp	ncc, Fails continuity test. Test point P28 to P42 is open.		Resolver	Imager Bench Assy	Receiver Assembly
CR3222280-1	Resolver will not realign.		04/02/2002	Resolver	Imager Bench Assy	Receiver Assembly
C3240063-0002	SG CITV sight assy #51196 failed because no picture/screen also fails DSETS.	CITV sight assy failed due to no picture/screen ; also failed DSETS. Block change incorporated.	03/22/2001	PLUNGER SPRING	Imager Bench Assy	Receiver Assembly
CR3222281-1	Fails Mirror stop alignment both ccw and cw position.		06/17/2002	PLUNGER SPRING	Imager Bench Assy	Receiver Assembly
C3222280-0001	Fails boresight achieved during CBIT.	Fails boresight achieved during CBIT.		OPS	Imager Bench Assy	Receiver Assembly

CW3222280-1	Faulty imager Assembly (Optics Dirty)		04/29/2002	Lens #1 Imager (alt)	Imager Bench Assy	Receiver Assembly
C3222280-0001	Misaligned Image wide field of view rotation EL	Misaligned Image wide field of view rotation EL	03/28/2001	Imager Bench Assy	Imager Bench Assy	Receiver Assembly
C3222280-0001	Fails @ ambient w/Scan Error when SMT scan control CCA is used. Intermittent; occurs @ 1st turnon. Rcvr p/o SMT Qual Test.	Fails @ ambient w/Scan Error when SMT scan control CCA is used. Intermittent; occurs @ 1st turnon. Rcvr p/o SMT Qual Test.	08/27/2002	Imager Bench Assy	Imager Bench Assy	Receiver Assembly
CR3222281-1	NO CUST. COMP.		07/29/2002	Imager Bench Assy	Imager Bench Assy	Receiver Assembly
CR3222281-1	NO CUST. COMP		07/29/2002	Imager Bench Assy	Imager Bench Assy	Receiver Assembly
CW3222280-1	Fails @ sys 5301 @ z-axis vibe sys. lost flir video while vibing	Fails @ sys 5301 @ z-axis vibe sys. lost flir video while vibing		Imager Bench Assy	Imager Bench Assy	Receiver Assembly

CW3222281-1	Fails VTT Boresight - FLIR video noisy. Target aquisition system would not align. Raytheon's field service rep removed TAS and t/s failure to a faulty Imager.	Fails VTT Boresight - FLIR video noisy.	06/12/2002	Imager Bench Assy	Imager Bench Assy	Receiver Assembly
CW3222281-1	No FIAR	No failure symptoms. Failed during DCX @ Ft Irwin.	07/29/2002	Imager Bench Assy	Imager Bench Assy	Receiver Assembly
CW3222280-1	resolver sine pins 27/41 reading OL, wire cut on resolver rotor	Resolver sine pins 27/41 reading OL, wire cut on resolver rotor.	08/29/2001	Resolver	Imager Bench Assy	Receiver Assembly
C3240063-0002	Long cooldown, image shifts in Horizontal 1/4 inch. Focus drive intermittent.	Long cooldown, image shifts in Horizontal 1/4 inch. Focus drive intermittent.	10/11/2001	Fold mirror, Imager	Imager Bench Assy	Receiver Assembly
C3222280-0001	NO FIAR, REPLACE FILTER WHEEL,RESOLVER,DID BLOCK	No FIAR.	01/24/2001	Filter whl Interface	Imager Bench Assy	Receiver Assembly

	BLOCK CHANGE,					
C3222280-0001	Scanner flutters after about 10 minutes of use and BKit shuts down.	Scanner flutters after about 10 minutes of use and BKit shuts down.	09/21/2001	Filter wheel pot	Imager Bench Assy	Receiver Assembly
C3222280-0001	Fax FIAR: Fails turnon & BIT @ -46C, Word 3=3000, s/b 0 (Moving filter wheel voltage & filterwheel position)	Fails turn-on & BIT @ -46C, Word 3=3000, s/b 0 (Moving filter wheel voltage & filter wheel position).	07/02/2002	Filter wheel pot	Imager Bench Assy	Receiver Assembly
C3222280-0001	B-kit flags 'Filter Wheel Position' during z-axis vibe while slewing in positive elevation and during transition from standby to surveillance	B-kit flags 'Filter Wheel Position' during z-axis vibe while slewing in positive elevation and during transition from	03/16/2001	Filter wheel pot	Imager Bench Assy	Receiver Assembly

		standby to surveillance.				
CR3222280-1	Unit failed filter wheel position, moving FW voltage + TRS2 overheat.	Unit failed filter wheel position, moving FW voltage & TRS2 overheat.		Filter wheel pot	Imager Bench Assy	Receiver Assembly
CR3222281-1	Failed DESETS.	Failed DSESTS.	02/26/2002	Filter wheel pot	Imager Bench Assy	Receiver Assembly

CW3222280-1	TRS1 &2 overheat, PS1 over & under voltage, PS1 over current	Rel op 170 6/6/01. PSA: Tested rcvr @ 23C: cooldown @ 00:05:47; Ch 12 dead in B-kit mode, Ch 469 dead in IBAS mode. Then performed 4 hour soak @ +65C (writeup directed test @ +52C; operated rcvr while chamber ramped up to +52C.). Tested in B-kit, CIV, IBAS & TIS modes without powering down rcvr. Rcvr passed all tests.	06/11/2001	Filter wheel pot	Imager Bench Assy	Receiver Assembly
CW3222280-1	FAILS FILTER WHEEL TEST BAND 1 & 2.OPAQUE & SPARE,ALSO			Filter wheel pot	Imager Bench Assy	Receiver Assembly

	30 & 60					
CW3222280-1	when running the filter wheel was vibrating. found that the	when running the filter wheel was vibrating. found that the filter wheel pot was causing the vibration. need to replace filter wheel pot.		Filter wheel pot	Imager Bench Assy	Receiver Assembly
CW3222280-1	Failed PBIT-on wheel voltage error	Failed PBIT-on wheel voltage error. Found potentiometer casing broken off.	08/16/2001	Filter wheel pot	Imager Bench Assy	Receiver Assembly
CW3222280-1	Fails f/w position and stationary f/w voltage @ thermal.	Fails FW position and stationary FW voltage @ -40C.	03/16/2001	Filter wheel pot	Imager Bench Assy	Receiver Assembly
CW3222280-1	Filter Wheel Position.	Filter Wheel Position @ -40C and +60C.		Filter wheel pot	Imager Bench Assy	Receiver Assembly

CW3222280-1	Failed SBIT/NBIT/BBKIT BKIT SU. TRS2 overheat, moving filter wheel voltage, filter wheel position fails. No FLIR video (cold temp failure).	Failed SBIT/NBIT/BBKIT BKIT SU. TRS2 overheat, moving filter wheel voltage, filter wheel position fails. No FLIR video (cold temp failure).		Filter wheel pot	Imager Bench Assy	Receiver Assembly
CW3222280-1	Black shadow radiating from target.. Negative crosstalk.	Black shadow radiating from target. Negative crosstalk (3.2.14.2). Extended source crosstalk, signal inversion (3.2.14.3) Failed @ AT station.	11/14/2001	Filter wheel pot	Imager Bench Assy	Receiver Assembly
CW3222280-1	No Cust. Comp. Fails Filter In Position test all Bands due to Pot. Meter is broken. Repair as Required.	ncc, Fails Filter In Position test all Bands.		Filter wheel pot	Imager Bench Assy	Receiver Assembly

CW3222280-1	Fails filter in position band1 and band2 due to filter wheel	Fails filter in position band1 and band2 due to filter wheel beginning to vibrate when in band 1 & 2 position.		Filter wheel pot	Imager Bench Assy	Receiver Assembly
CR3222281-1	FAILED DESETS	Failed DSESTS.	03/18/2002	Filter wheel pot	Imager Bench Assy	Receiver Assembly
CR3222280-1	No video filter wheel & filter wheel pos. fail.	No video, filter wheel & filter wheel position fail.		Filter wheel pot	Imager Bench Assy	Receiver Assembly
C3222280-0001	fails wiring & component test wheel motor reads 60 ohms	Fails wiring & component test; filter wheel motor reads 60 ohms.		Filter wheel motor	Imager Bench Assy	Receiver Assembly
C3222280-0001	Bad SADA CHANNEL- NO VIDEO	Bad SADA CHANNEL- NO VIDEO	05/24/2000	Filter wheel motor	Imager Bench Assy	Receiver Assembly

C3222280-0001	Fails CBIT/NBIT-FILTER WHEEL CURRENT	Tom Heath measured filter wheel motor @ 15-28 ohms; replaced it based on customer's failure symptom even though resistance is in normal tolerance. Also found imager front lens was dirty; cleaned it. Rcvr completed flow 10/17/00.	05/24/2000	Filter wheel motor	Imager Bench Assy	Receiver Assembly
3222280-0001-CR	Live Fire TAS returned by UDLP. VDMS Codes: 14053, 14153, 14156, 14449, 14415. From IBAS 3271797. Motor resistance 116 Ohms depending on Fltr Wheel	Morris passed motor to Rick Huggins for analysis. Receiver completed test with no other fails 9/21/00. Receiver completed flow 9/22/00;	05/24/2000	Filter wheel motor	Imager Bench Assy	Receiver Assembly

	Position.	shipped 9/26/00.				
C3222280-0001	CIV safe-to-turn-on failure, fails N15A-RTN reads 543 ohms fails RTN-N15A reads 539 ohms.	CIV safe-to-turn-on failure, fails N15A-RTN, reads 543 ohms. Fails RTN-N15A, reads 539 ohms.		Filter wheel motor	Imager Bench Assy	Receiver Assembly
C3222280-0001	Fails VDMS tests: Filter Wheel Faults.	Fails VDMS tests: Filter Wheel Faults.	05/24/2000	Filter wheel motor	Imager Bench Assy	Receiver Assembly
CR3222280-1	Fails DSETS normalization and f/w position tests.	PEI input: failed DSESTS normalization and filter wheel position tests.		Filter wheel motor	Imager Bench Assy	Receiver Assembly
CR3222280-1	Failed CIV SAU tests: moving FW voltage, FW position, stationary FW voltage. Failed	Failed ambient CIV SAU tests: moving FW voltage, FW position, stationary FW voltage.		Filter wheel motor	Imager Bench Assy	Receiver Assembly

	at ambient					
CR3222281-1	No cust. comp	ncc, Failed imager check; pin 34 to 35 reads over 50 ohms, spec is 9 to 50 ohms.		Filter wheel motor	Imager Bench Assy	Receiver Assembly
CR3222281-1	NO CUST. COMP	Broken filter wheel motor (electrically)	06/25/2002	Filter wheel motor	Imager Bench Assy	Receiver Assembly
CR3222281-1	Failed DSETS	Fails Imager wiring check. pins 34 to 35 open Filter Motor.		Filter wheel motor	Imager Bench Assy	Receiver Assembly
CW3222280-1	Fails PBIT- stationary filterwheel voltage, moving f/w voltage and f/w position.	Fails PBIT- stationary filterwheel voltage, moving f/w voltage and f/w position.		Filter wheel motor	Imager Bench Assy	Receiver Assembly
CW3222280-1	Fails stationary filter wheel voltage.			Filter wheel motor	Imager Bench Assy	Receiver Assembly

CW3222280-1	Failed BIT FOV position filterwheel position, moving filter wheel voltage.	Failed BIT: FOV position, filterwheel position, moving filter wheel voltage.		Filter wheel motor	Imager Bench Assy	Receiver Assembly
CW3222280-1	Failed filter wheel position and TRS 2 overheat.	Failed filter wheel position and TRS 2 overheat.		Filter wheel motor	Imager Bench Assy	Receiver Assembly
CW3222280-1	Failed u.t. bit-filter wheel position and moving filter wheel voltage.			Filter wheel motor	Imager Bench Assy	Receiver Assembly
CW3222280-1	Fails sys. level mrtd test @ HOT for a 2.5 cyc/mrad target in NFOV and a 0.5 cyc/mrad target in WFOV.			Filter wheel motor	Imager Bench Assy	Receiver Assembly
CW3222281-1	No FIAR	No FIAR		Filter wheel motor	Imager Bench Assy	Receiver Assembly
CW3222281-1	No FIAR			Filter wheel motor	Imager Bench Assy	Receiver Assembly

C3222280-0001	Day TV will not change FOV. (Not dup @ Rayth, but SAU failed filter wheel position & FW stationary voltage BIT.)	Day TV will not change FOV. (Not dup @ Rayth, but SAU failed filter wheel position & FW stationary voltage BIT.)		Filter wheel motor	Imager Bench Assy	Receiver Assembly
CW3222280-1	Failed thermal @ hot and cold filterwheel position + moving filter wheel voltage.	Failed thermal @ hot and cold filterwheel position + moving filter wheel voltage.		Filter wheel motor	Imager Bench Assy	Receiver Assembly
CW3222281-1	No cust. comp	ncc, Fail imager wiring check @ pin 35 to 34 (filter wheel motor reads 97.7 OHM, spec is 9 TO 50 ohms.		Filter wheel motor	Imager Bench Assy	Receiver Assembly
CW3222281-1	No FIAR	No failure data; test as a receiver.		Filter wheel motor	Imager Bench Assy	Receiver Assembly
C3222280-0001	Filter wheel failure	Filter wheel failure.	11/09/2000	Filter wheel interface	Imager Bench Assy	Receiver Assembly

C3222280-0001	Fails filterwheel position BIT, filterwheel current, and missing gear teeth on the wheel.	Fails filterwheel position BIT, filterwheel current, and missing gear teeth on the wheel.	11/09/2000	Filter wheel interface	Imager Bench Assy	Receiver Assembly
CW3222280-1	Fails filter select delta amplitude MAN2 @ 1st test ambient.	Fails filter select delta amplitude MAN2 @ 1st test ambient.	12/12/2001	Filter Wheel Assy	Imager Bench Assy	Receiver Assembly
C3222280-0001	TRU fails BIT test @ ambient temp for: Scan error and TRS1 overheat.	TRU fails BIT test @ ambient temp for: Scan error and TRS1 overheat.	04/16/2001	Filter Wheel	Imager Bench Assy	Receiver Assembly
C3222280-0001	Missing channels (Ft. Hood Return).	Missing channels (Ft. Hood Return).		Filter wheel	Imager Bench Assy	Receiver Assembly
C3222280-0001	No FLIR Video		12/18/2001	Filter wheel	Imager Bench Assy	Receiver Assembly

C3222280-0001	General fail; SU LRU fail; Boresight achieved; TRS2 Overheat-BIT	Unit was tested @ +25C. Also tested w/versions 5.01 & 5.065 software in B-Kit & CIV modes. CND. Operation 110 was skipped 10/13/00 in order to ship same day. Orig ESD37957 chained 1/29/01: "Tested unit at +25C with software ver 5.01 & 5.065 in B-Kit & CIV modes. CND failure. Return to CRM Configuration."	05/23/2000	Filter wheel	Imager Bench Assy	Receiver Assembly

CR3222280-1	OPS OUT OF ALIGNMENT	OPS OUT OF ALIGNMENT; OPS plate mounting screws stripped out.		Filter Wheel	Imager Bench Assy	Receiver Assembly
CW3222280-1	IBIT FAILS-LSR SYSTEM FAIL, HTI BKIT FAIL, LSR PULSE RANGE			Filter Wheel	Imager Bench Assy	Receiver Assembly
CR3222280-1	BIT ST15 TIS status fail. Moving filter wheel voltage, filter wheel position, SADA bad channels grayscale.	BIT ST15 TIS status fail. Moving filter wheel voltage, filter wheel position, SADA bad channels grayscale.	12/18/2001	Filter wheel	Imager Bench Assy	Receiver Assembly
CR3222281-1	FAILED DESETS	Failed DSESTS.	12/18/2001	Filter wheel	Imager Bench Assy	Receiver Assembly
CR3222281-1	FAILED DESETS	Failed DSESTS.	12/18/2001	Filter wheel	Imager Bench Assy	Receiver Assembly
CR3222281-1	FAILED DESETS	FAILED DESETS.	12/18/2001	Filter wheel	Imager Bench Assy	Receiver Assembly
CR3222281-1	FAILED DESETS.	Failed DSESTS.		Filter wheel	Imager Bench Assy	Receiver Assembly

CW3222280-1	Fails Filter in Position at unit test.	Fails Filter in Position at unit test. Clear to band1and clear to band2 lens are positioned wrong.		Filter wheel	Imager Bench Assy	Receiver Assembly
CW3222280-1	Fails filter wheel position BIT	Fails filter wheel position BIT.	12/18/2001	Filter wheel	Imager Bench Assy	Receiver Assembly
CW3222280-1	Fails filter wheel position BIT	Fails filter wheel position BIT.	12/18/2001	Filter wheel	Imager Bench Assy	Receiver Assembly
CW3222280-1	filter wheel has missing teeth			Filter wheel	Imager Bench Assy	Receiver Assembly
CR3222281-1	Failed DESETS	Failed DSESTS. Gear teeth damaged.	12/18/2001	Filter wheel	Imager Bench Assy	Receiver Assembly
CW3222280-1	Wheel gears grinding only when you go from clear to band 1		07/02/2002	Filter wheel	Imager Bench Assy	Receiver Assembly
CW3222280-1	Filter Select Delta Amplitude	Filter Select Delta Amplitude Man 2.	02/01/2002	Filter No. 2	Imager Bench Assy	Receiver Assembly

CW3222280-1	Filter select delta amplitude man2.	Filter select delta amplitude man 2.	02/01/2002	Filter No. 2	Imager Bench Assy	Receiver Assembly
CW3222280-1	Filter Select Delta Amplitude Man 2	Filter Select Delta Amplitude Man 2.	02/01/2002	Filter No. 2	Imager Bench Assy	Receiver Assembly
CW3222280-1	FILTER SELECT DELTA AMPLITUDE (MAN 2)	Filter Select Delta Amplitude (MAN 2).	02/01/2002	Filter No. 2	Imager Bench Assy	Receiver Assembly
CW3222280-1	FILTER SELECT DELTA AMPLITUDE.	Filter Select Delta Amplitude.	02/01/2002	Filter No. 2	Imager Bench Assy	Receiver Assembly
CW3222280-1	FILTER SELECT DELTA AMPLITUDE	Filter Select Delta Amplitude.	02/01/2002	Filter No. 2	Imager Bench Assy	Receiver Assembly
CW3222280-1	Fails filter select Delta Amplitude MAN2 @ 1st test ambient.	Fails filter select Delta Amplitude MAN2 @ 1st test ambient.	02/01/2002	Filter No. 2	Imager Bench Assy	Receiver Assembly

CR3222280-1	Failed (normalization) in the TIS-SGTRU using an SMT scan control. Failed scanner resolver excitation test (BIT test)	Failed (normalization) in the TIS-SGTRU using an SMT scan control. Failed scanner resolver excitation test (BIT test) in the CITV-SGSA.	11/14/2001	Connector, 44 pin	Imager Bench Assy	Receiver Assembly
CW3222280-1	FLIR FAIL message displayed in biocular on power-up. Also BIT failures flagged for the following: BKIT, boresight achieved, filterwheel position, moving filter-wheel voltage.		07/18/2002	Connector, 44 pin	Imager Bench Assy	Receiver Assembly
CW3222280-1	replaced cooler cable p1 (original date of write up on 2-11-02)		07/18/2002	Connector, 44 pin	Imager Bench Assy	Receiver Assembly

CW3222280-1	Fails filter wheel pos. and filter wheel voltage, and TRS2 overheat.		07/18/2002	Connector, 44 pin	Imager Bench Assy	Receiver Assembly
CW3222280-1	Fails in UT, missing part of video. Replace receiver.	Fails in UT, missing part of video.	08/28/2001	Connector, 44 pin	Imager Bench Assy	Receiver Assembly
CW3222280-1	IBITfailed with word 2=480 (SU, BKIT), AND 15=20 (SADA Serial IO		08/12/2002	Connector, 44 pin	Imager Bench Assy	Receiver Assembly
CW3222281-1	Fails DSETS	DSESTS fail noted but no symptoms included.	08/07/2001	Connector, 44 pin	Imager Bench Assy	Receiver Assembly
CW3222280-1	NBIT/BBIT SGCEU, SAU, BKIT 2D FILTER FAIL.		07/18/2002	Connector, 44 pin	Imager Bench Assy	Receiver Assembly
CW3222281-1	bend connector p1 and out of alignment		07/18/2002	Connector, 44 pin	Imager Bench Assy	Receiver Assembly
C3222280-0001	Failed NFOV to WFOV @ -3.9 mRads. (alignment)	Failed NFOV to WFOV @ -3.9 mRads (alignment).		Connector, 10 pin	Imager Bench Assy	Receiver Assembly

C3222280-0001	DRS DMR #15251: Damaged wire, exposed conductor, no video.	Damaged wires on P2 connector.	01/22/2001	Connector, 10 pin	Imager Bench Assy	Receiver Assembly
CW3222281-1	No FIAR	No FIAR	07/30/2001	Connector, 10 pin	Imager Bench Assy	Receiver Assembly
CR3222280-1	Filter wheel gear damaged. P1 connector bracket bent and pushed down.			Bracket, Connector	Imager Bench Assy	Receiver Assembly
C3222280-0001	Scan motor cannot be adjusted due to rough spot on bearing	Scan motor cannot be adjusted due to rough spot on bearing replace scan bearings.	06/05/2000	Bearings, Scan	Imager Bench Assy	Receiver Assembly

C3240063-0002	Fails DSETS CITV picture wavy.	Bearings are the most likely LFC but could have been wave washer; the troublesheet did not record what was determined as root cause prior to block change incorporation. Damaged headmirror handles were found @ incoming inspection but Raytheon replaced them. Imager housing broken @ IEL during repair; housing replaced. Imager 51512, cooler bench 51502.	06/05/2000	Bearings, Scan	Imager Bench Assy	Receiver Assembly

		Ready to ship 2/12/01.				

CR3222280-1	Fails Part-A rcvr test, couldn't get an image for target.	Fails Part-A rcvr test, couldn't get an image for target. The Imager has some roughness in the scan mirror rotation. Unit needs block change (for scan bearing.)	06/05/2000	Bearings, Scan	Imager Bench Assy	Receiver Assembly
C3222280-0001	Fails PBIT; BKit fail & scan error, no FLIR video	Fails PBIT; BKit fail & scan error, no FLIR video.	06/05/2000	Bearings, Scan	Imager Bench Assy	Receiver Assembly
CR3222281-1	FAILED DESETS	Failed DSESTS.	02/26/2002	BEARING FILTER W	Imager Bench Assy	Receiver Assembly

C3222280-0001	Loss of Flir video. VDMS 21002- SGCEU bit summary 21004-SAU BIT	Found filter wheel motor operation ok; had old style stop and wheel was stuck. Installed new stops. Failed resolution 9/20/00 and Adam thought the shims were adjusted but no entry for the fix was on the T/S. Completed test 10/16/00.	10/26/2000		Imager Bench Assy	Receiver Assembly

C3222280-0001	No Cool Down symbol, Noisy FLIR video, TRS2 overheat	9/19/00 Tom Heath did incoming: imager wire tie wrap missing, one cooler clamp pin bent. Adjusted scan motor. Cooler motor noisy after 3 minutes running. SADA A0005/251 replaced w/1292 on 9/20/00. 9/20/00 failed cooldown; according to Brad this cooldown fail was test connector induced. A D shell conductor was being used in place of a Mil connector. SADA	08/27/2002	SADA II	Det/Cooler	Receiver Assembly

		A0005/251 is in PET lab as of 9/20/00 awaiting further instructions; noisy coolers are temporarily being held. Rcvr completed repair flow 9/25/00.				

C3222280-0001	pins 27 & 41 are open	4/24/01: Failed U.T. for "BKit BIT status flagged TRS2 overheat and fail SADA EEPROM." SADA 142 replaced w/716.	05/24/2002	SADA II	Det/Cooler	Receiver Assembly
C3222280-0001	fails after cooldown time, audible noise from sada	Fails after cooldown time, audible noise from SADA; noisy after recycling power.	05/24/2002	SADA II	Det/Cooler	Receiver Assembly
C3222280-0001	Cooler can not be centered preventing the receiver from being installed in the TKU housing.	Cooler can not centered, preventing the receiver from being installed in the TRU housing.	04/04/2001	SADA II	Det/Cooler	Receiver Assembly

C3222280-0001	Fails SAU UT RA 28v cooler return to chassis (open) @ ambient temp in production.	9/15/00 chain shows: bkit & fu failed for moving filter wheel voltage & filter wheel position; needs trblsht. 9/19/00 Tom Heath found FWM resistance 14-18 ohms and rcvr was CND for customer complaint. Paperwork completed 9/20/00; deliv to Rel 9/26/00.	05/23/2000	SADA II	Det/Cooler	Receiver Assembly
CW3222280-1	Failed cooldown	Failed cooldown; didn't cool down in 15 minutes.	04/29/2002	SADA II	Det/Cooler	Receiver Assembly
CW3222280-1	Band of video just above center.			SADA II	Det/Cooler	Receiver Assembly
CW3222280-1	Failed IBIT, bkit fail, su fail, SADA serial I/O.		11/14/2001	SADA II	Det/Cooler	Receiver Assembly

CW3222280-1	SADA SERIAL I/O + TRS2 TEMP SENSOR		04/29/2002	SADA II	Det/Cooler	Receiver Assembly
C3222280-0001	Black bar in 30HZ.	10/13/00 Chain: "Tested reviever in B-Kit, CIV, & TIS modes at +25C. Cooldown time: 00:06:51. Unit has some noise at 30/60Hz but passed specs. CND failure per Hector Reyes. Return to customer." 10/14/00 Chain: "has multiple (white) lines in 60hz. need to re-evaluate before sending back to customer." Hector and Jean Cathcart looked at the	05/23/2000	SADA II	Det/Cooler	Receiver Assembly

		lines and determined they were gray, not white, and therefore within spec. Rcvr is CND. Completed flow 10/17/00.				

C3222280-0001	Wavy lines passing through video & video flickers word4=1000	9/29/00 chain (logged originally as ESD37394): "fail left jitter test, vibrate outside the box needs troubleshoot." 10/11/00 chain (logged originally as ESD37863): "At +25C, ch 416 was noisy, no dead channels. Soaked unit at -48C 1 hr. Dead ch 36,40,117, 255, 381, 429, & 455 at 30 Hz only. At 30 Hz there was many white horz lines in video. Unit fails." Incorporate Block change also.	07/02/2002	SADA II	Det/Cooler	Receiver Assembly

		12/6/00: Troublsheet shows SADA 146 (described above) was replaced by 00692. 00692 pretested good but failed cooldown 9/22/00 in 51088; was replaced by SADA 1094. During block change, white wires (sic) from pot to P1 connector accidently cut; were replaced. Completed test successfully after vib per U01409MR and Burn-in per U01404FF.				

C3222280-0001	FAIL DEFECTIVE CHANNEL @ 60Hz (242 DEAD CHANNEL)	FAIL DEFECTIVE CHANNEL @ 60Hz (242 DEAD CHANNEL)	08/01/2001	SADA II	Det/Cooler	Receiver Assembly
C3222280-0001	No FIAR - Failure at Ft Hood in IBAS. DD 1149 faxed 9-13-00: "Causes channels to block out and become noisy @ top of display. Cooler knocking after 10 minutes of use."	Testing for an hour w/switch off, wait 3 minutes, switch back on did not replicate the knocking. Multiple white lines in video when running 60 Hz; Tom Heath verified lines pass criteria. Rcvr is CND. Filter wheel stop is peanut design but, per Morris' telecon w/Drew, do not hold shipment up to replace it.	05/23/2000	SADA II	Det/Cooler	Receiver Assembly

C3222280-0001	Cooler noisy then system shuts down. Cooler noise came after cooling down; rcvr was drawing 9.5 Amps.	Rcvr failed @ +25C when SADA failed to cool down. Also SADA emitted low-toned rhythmic humming during cooldown only. SADA 401 replaced w/Sofradir 12199. From former ESD37895: "Tested SADA (RIO 401)at +25C. Unit failed cooldown time limit. Also cooler emitted low toned rymithic humming until end of cooldown. Unit fails for cooldown & audible noise. RTN to	07/02/2002	SADA II	Det/Cooler	Receiver Assembly

		vendor." Still need to run one hot and one cold cycle before shipping. Is still on shelf awaiting temp test as of 10/22/00. From former ESD40153: "Fails resolver alignment. Will not align properly. Replace resolver with p/n 1917070-1." Sofradir 12199 was repl w/146. Block change done. Orig entry as ESD41584: "FAILS COOLDOWN TIME; REFERENCE FAILURE TO ESD 37152;				

		REPLACE SADA S/N 12199 W/146." 1/25/01 chain: "fails wiring & component test; wheel motor reads 60 ohms; replace fitler wheel motor" Orig entry ESD41606 for Sofradir SADA 12199 eval: "V6.01 released. Rtn to WIP."				
C3222280-0001	FAILS COOLDOWN TIME	Non-Rel LFC added.	01/30/2001	SADA II	Det/Cooler	Receiver Assembly

C3222280-0001	Tested unit at +23C. Cooldown was 00:04:39. Ch 193 dead. Unit fails specs for dead channel in center 20% region of the rastor.	Tested unit at +23C. Cooldown was 00:04:39. Ch 193 dead. Unit fails specs for dead channel in center 20% region of the rastor. Return to vendor.	07/02/2002	SADA II	Det/Cooler	Receiver Assembly
C3222280-0001	NO FIAR	NO FIAR (no symptoms).	07/02/2002	SADA II	Det/Cooler	Receiver Assembly
C3222280-0001	FAIL COLD MASSIVE DEAD CHANNEL FAILURE	FAIL COLD MASSIVE DEAD CHANNEL FAILURE	02/12/2001	SADA II	Det/Cooler	Receiver Assembly
C3222280-0001	Noisy cooler	Noisy cooler.	05/24/2002	SADA II	Det/Cooler	Receiver Assembly

C3222280-0001	Failed SADA bad channels and boresight achieved (DRS-PB). Ref	9/15/00 cooler noisy and was replaced. SADA 438 replaced w/1283. Per Howard Creswick 9/22/00, had P1 connector height checked and checked P1 for damage. Completed repair 9/23/00.	07/02/2002	SADA II	Det/Cooler	Receiver Assembly

C3222280-0001	Cool down problem	11/6/00 chain: "Tested unit at +22C, +65C, & -46C in B-Kit / TIS / CIV modes. Unit failed at -46C, 10 minutes into testing.Bit fail occurred: SADA Bad Channels. Massive dead channels. RTN to DRS." DRS 314 replaced w/1393 10/31/00. Tested rcvr w/new SADA @ +25C, +65C, & -46C w/2 hr soak time @ each temp. @ +25C cooldown was 00:06:09, Ch 285 was noisy. @ +65C	02/27/2002	SADA II	Det/Cooler	Receiver Assembly

		cooldown was 00:11:16. Ch 293 was dead @ 30 Hz only. @ -46C cooldown was 00:04:10. Rcvr passed test.				

C3222280-0001	No cool down; lack of image.	9/25 failed cooler cooldown. 9/27/00 SADA 342 replaced w/pretested 1336. CRM completed flow 10/2/00; paperwork to Rel 10/5/00.	07/02/2002	SADA II	Det/Cooler	Receiver Assembly
C3222280-0001	Receiver would not cool down. Fail occurred 2 hrs into thermal survey @ +60c. (SADA was replaced 6/00)		07/02/2002	SADA II	Det/Cooler	Receiver Assembly
C3222280-0001	Failed Complete Cycle test-step 2 forward @ 30HZ. Reading was 45.01HZ.	Failed Complete Cycle test-step 2 forward @ 30HZ. Reading was 45.01HZ.	02/13/2001	SADA II	Det/Cooler	Receiver Assembly
C3222280-0001	v6.01 released. Rtn to WIP.	v6.01 released. Rtn to WIP.	01/24/2001	SADA II	Det/Cooler	Receiver Assembly

C3222280-0001	Failed to achieve cooldown and volts out P8A at cold and Hot1.	Imager had damaged wires on P2 connector (entered on ESD36344 per T/S.) 9/15/00 missing hardware on cooler cable @ J2 identified. 9/21/00 tested recvr @ 25C & 69C; SADA fails bad channels @ 69C @ 60 Hz. Replaced SADA 414 w/1347 9/24/00; also replaced P2 wires. 10/2/00 wrote up to check for P1 position damage. Corrected paperwork to chain ESD36344 to	07/02/2002	SADA II	Det/Cooler	Receiver Assembly

		this event. CRM completed flow 10/2/00; paperwork to Rel 10/5/00.				

C3222280-0001	Receiver failed to achieve cooldown and sada bad channels.	Noted bent pin on cooler clamp. Tested SADA MSN 1225 (RIO) in receiver MSN 51643 at +65C. 10/4/00 Entries: (1) SADA failed cooldown 15 min limit. Replace SADA [w/RIO 515] and return to PSA for processing unit to be returned to vendor. (2) Tested unit at +65 to verify operation. Tested ok at +65C. Suspected SADA problem at cold. Tested at -49C (Soak time 14hs). Unit fails	07/02/2002	SADA II	Det/Cooler	Receiver Assembly

		massive bad channels.Repl [RIO 515] w/1083 SADA, return to PSA.				

C3222280-0001	Noise on channel #238.	Noise on channel #238 per customer writeup (violates requirement for "no defects" in center 10 channels.)	09/21/2001	SADA II	Det/Cooler	Receiver Assembly
C3222280-0001	After 2 minutes shut down in +65c unit failed turn-on and Bit word 1=100. Unit continued to fail word1=100 even @ ambient.	BIT word 1 should be zero. Word1 = 100 is TRS1 overheat. Found 2 bent cooler clamp pins @ incoming inspection. At test, cooler motor draws normal current but doesn't cool down. Replaced SADA DRS 430 w/1364. Last note on troublesheet 9/27/00: "Cooler clamp pins broken";	07/02/2002	SADA II	Det/Cooler	Receiver Assembly

		no resolution as to use-as-is or replacement was documented.				

C3222280-0001	TRU 321 fails crosstalk test at first test. (DRS-PB)	Original SADA, RIO SADA 1235, repl w/RIO 1300 9/20/00. Test of 1235: "Crosstalk-Video on line 313 is displaced 15 pixels to the left. (Tom Heath)" Unrelated to customer fail: 9/21/00 chain shows a-therm is sticking. need to reclean and regrease a-therm. From original entry ESD38316 on RIO SADA 1300: "Tested unit at +25C in B-Kit, CIV, & TIS modes. Cooldown was 00:6:32. Ch 129 was	01/24/2001	SADA II	Det/Cooler	Receiver Assembly

		noisy. Video is stable. Brad Swiger concur that SADA passed specs. CND customer complaint. Return to mfg flow." RIO 1300 repl w/12595. Orig ESD41615 on SADA 12595 chained: "Tested unit at +22C, cooldown was 00:05:11. No defects seen. CND failure, Rtn to WIP." Block change done. Rcvr still in test area 1/22/01. Chain from original ESD39865 entry: "fail safe to turn on				

		test (stto) -5 VDC short test (value 49.5). Mirror stop nearest P1 was found to be damaged; was replaced." SADA 12595 repl w/16499 1/16/01.				
C3222280-0001	Tested unit at +25C in B-Kit, CIV, & TIS modes.	Chained. Original entry as ESD38316.	02/13/2001	SADA II	Det/Cooler	Receiver Assembly

	Cooldown was 00:6:32. Ch 129 was noisy.					
C3222280-0001	Fails Cooldown time.	Failed safe to turn on test (STTO); -5 VDC short test (value 49.5)	01/24/2001	SADA II	Det/Cooler	Receiver Assembly

C3222280-0001	TRU coolsdown @ ambient temp but will not cooldown @ hot temp.	Tested @ 25C w/cooldown in 00:07:51. Tested @ +65C and failed cooldown. Afocal temp @ cooldown was 81 degrees Kelvin (K). SADA 1180 replaced w/Sofradir 12736. Need to run one hot and one cold cycle before shipping; still on shelf as of 10/22/00 awaiting temp test. SADA required EEPROM reprogramming but that was done on-site by Bill	11/19/2001	SADA II	Det/Cooler	Receiver Assembly

		McKeag (DRS rep?) SADA 1180: "Tested unit at +25C in RMR Reciever MSN 51740. Cooldown time was 00:07:51. Next tested unit at +65C. Unit failed cooldown. At 00:15:00, FPA temp was 81K. Return to vendor." Chain from orig ESD41763: failed jitter test. Incorporated block change and replaced filter wheel stop.				
C3222280-0001	ALSO FAIL AT HOT FPA TEMP REACHED 78K @ TIME MARK		02/13/2001	SADA II	Det/Cooler	Receiver Assembly

	@ TIME MARK 00:09:30.					
C3222280-0001	Fail vibration: Distorted video, pre and post vibe	Tom Heath noted 10/13/00 that rcvr CNDed for "distorted video". Rel wroteup t/s 10/24/00 to "perform vibration test as a B-kit per B-kit procedure" after discussion w/Brad Swiger. Howard Creswick concurs in the plan to vib this rcvr. Per 11/7/00 testing: "VIDEO BREAKS UP DURING VIBE, WD6= SADA BAD	07/02/2002	SADA II	Det/Cooler	Receiver Assembly

		CHANNELS. TRS2 OVERHEAT DURING IBIT." ESD40399 was entered after SADA test and 12/15/00 Rel had to chain the following to this event: "Tested unit at +23C. Cooldown was 00:06:19. After cooldown, bit fail: word 3=200 TRS2 Overheat. Also there was no video. Unit fails, return to vendor." SADA 1239 repl w/600.				

C3222280-0001	Receiver exhibited no cooldown failure mode @ room.	Per 11/6/00 chain: "FPA temperature diode stuck at 281K at room temperature. Return to vendor. (NC rpt orig. entered as ESD39107; chained by Rel.) SADA Receiver exhibited no cooldown failure mode @ room.	07/02/2002	SADA II	Det/Cooler	Receiver Assembly
C3222280-0001	Failed pre-AT; no cooldown @ room temp	Failed pre-AT; no cooldown @ room temp.	04/17/2002	SADA II	Det/Cooler	Receiver Assembly

C3222280-0001	SADA bad channel @ approx. 250 pixel.	SADA bad channel at approx. 250 pixel per DRS on attached DMR 16700. (No idea why this is marked "no FIAR".) Per chained 1/26/01 entry under ESD41667: "Tested unit at +22C, +65C, & -46C in B-Kit / TIS / CIV modes. Unit failed at -46C, 10 minutes into testing during power reset. SADA Bad channels, massive dead channels. Unit fails,rtn to vendor."	07/02/2002	SADA II	Det/Cooler	Receiver Assembly

C3222280-0001	Fails @ 60c: Globalizational/Polarity, TRS sums/VP vertical direction, VP1 control signature, fails to achieve cooldown.	Orig ESD41588 for Sofradir SADA 14691: "Tested sada at +22C. At start of cooldown, FPA temperature is stuck at 287K. Unit fails cooldown. Return to vendor." New SADA was MSN 1519. 2/9/01:FAILS CYCLE TEST STEP A AND D.FORWARD 30 HZ.(POS #4 purple). [Rel. Note: CND cycle test failure per troublesheet 2/22/01.] [Orig. ESD42388 chained 2/22/01. jw]	07/02/2002	SADA II	Det/Cooler	Receiver Assembly

C3222280-0001	Ambient fail; dead channels	Ambient fail; dead channels	04/16/2001	SADA II	Det/Cooler	Receiver Assembly
CR3222280-1	FLIR not working.	FLIR not working. Fails PBIT. SADA bad; cooler heat sink damaged.	03/01/2002	SADA II	Det/Cooler	Receiver Assembly
CR3222280-1	No Cust. Comp	Bank 1 dead at 30Hz. Bank 1 and 2 dead at 60Hz.	04/29/2002	SADA II	Det/Cooler	Receiver Assembly
CW3222280-1	OK to replace SADA	Bad SADA.	12/18/2001	SADA II	Det/Cooler	Receiver Assembly
CR3222280-1	Bad Detector Cooler		05/21/2002	SADA II	Det/Cooler	Receiver Assembly
CR3222280-1	Noisy channels across top of display.	Noisy channels across top of display.	09/21/2001	SADA II	Det/Cooler	Receiver Assembly

CR3222280-1	Fails cooldown time and bad channels	Tested unit at +24C, cooldown was 00:04:53. No defects seen. Next tested at -40C, cooldown was 00:03:20. Strong vertical lines at 30/60 Hz. Per Brad Swiger, return to DRS.	07/02/2002	SADA II	Det/Cooler	Receiver Assembly
CR3222280-1	Fails Word 1=8 Scan Error	Fails Word 1=8 Scan Error. Failed @ -40C.	07/02/2002	SADA II	Det/Cooler	Receiver Assembly
CR3222280-1	Scannner flutters then locks b-kit up on SAU test station.		04/24/2002	SADA II	Det/Cooler	Receiver Assembly
CR3222280-1	Excessive noise during cooldown	Excessive noise during cooldown & @ power up, @ 25c temp.	04/29/2002	SADA II	Det/Cooler	Receiver Assembly
CR3222280-1	FLIR FAIL message displayed in biocular.	FLIR FAIL message displayed in biocular.	04/29/2002	SADA II	Det/Cooler	Receiver Assembly

CR3222280-1	No cust comp		08/16/2002	SADA II	Det/Cooler	Receiver Assembly
CR3222280-1	Fails turn-on word 4=1000 SADA bad channels & jitter thoughout.			SADA II	Det/Cooler	Receiver Assembly
CR3222280-1	SADA SERIAL I/O	SADA Serial I/O.	11/14/2001	SADA II	Det/Cooler	Receiver Assembly
CR3222280-1	No video images during testing, also unit flag a bit error word1	Tested sada at +23C. Immediately after engaging B-Kit power, Bit fail occurs, Word 3=200 Fail TRS2 Overheat. System also tries to go to active video mode instead of stand-by for cooldown. FPA	04/29/2002	SADA II	Det/Cooler	Receiver Assembly

CW3222280-1	Unit was in TRU when chamber was purged with day air causing failure of main flex.	Unit was in DRS TRU 388 when (cold) chamber was purged with dry air from a compressor causing failure of main flex.	08/07/2001	SADA II	Det/Cooler	Receiver Assembly
CR3222281-1	cooler cooldown test failed with reading = 14.4 minutes.			SADA II	Det/Cooler	Receiver Assembly
CR3222282-1	No Cust. Comp			SADA II	Det/Cooler	Receiver Assembly
CR3222282-1	Failed DSESTS		06/17/2002	SADA II	Det/Cooler	Receiver Assembly
CR3222282-1	No cust. comp	ncc, Video has ghost images from top to bottom @ +25c.	04/29/2002	SADA II	Det/Cooler	Receiver Assembly
CR3222282-1	No Cust. Comp			SADA II	Det/Cooler	Receiver Assembly
CR3222282-1	No Cust. Comp	FAIL TRS2 OVERHEAT @ 25c	04/29/2002	SADA II	Det/Cooler	Receiver Assembly

CR3222282-1	NO CUST COMP	Fails for very loud audible noise during cooldown.	04/29/2002	SADA II	Det/Cooler	Receiver Assembly
CR3222282-1	NO CUST. COMP	Fails cooldown monitor, TRS 2 overheat. Extreme audible noise from cooler.	04/29/2002	SADA II	Det/Cooler	Receiver Assembly
CR3222282-1	No cust. comp	ncc, Audible noise during cooldown only. @+25c.	04/29/2002	SADA II	Det/Cooler	Receiver Assembly
CR3222282-1	No cust. comp			SADA II	Det/Cooler	Receiver Assembly
CR3222282-1	No cust. comp			SADA II	Det/Cooler	Receiver Assembly
CR3222282-1	No Cust. Comp	ncc, Noisy sada @ 25c.	04/29/2002	SADA II	Det/Cooler	Receiver Assembly
CR3222282-1	FAIL TRS2 OVERHEAT @ 25c.	ncc, FAIL TRS2 OVERHEAT @ 25c	04/29/2002	SADA II	Det/Cooler	Receiver Assembly

CR3222282-1	No cust. comp.			SADA II	Det/Cooler	Receiver Assembly
CR3222282-1	No cust. comp	ncc, NOISY SADA @ TURN ON @ RM. TEMP. (25c)	04/29/2002	SADA II	Det/Cooler	Receiver Assembly
CR3222282-1	NO CUST. COMP			SADA II	Det/Cooler	Receiver Assembly
CR3222282-1	No Cust. Comp			SADA II	Det/Cooler	Receiver Assembly
CR3222282-1	No cust. comp	scc, SADA's EEPROM manufacture ID incorrect.	04/17/2002	SADA II	Det/Cooler	Receiver Assembly
CR3222282-1	Failed on DSESTS replace A83	Failed on DSESTS replace A83. No symptoms provided.	09/18/2001	SADA II	Det/Cooler	Receiver Assembly
CR3222282-1	No cust. comp	FAIL TRS2 OVERHEAT @ 25c.	04/29/2002	SADA II	Det/Cooler	Receiver Assembly
CR3222282-1	NO CUST. COMP	Unit fails FPA temp, reading = 0 degree @+25c.	04/02/2002	SADA II	Det/Cooler	Receiver Assembly

CR3222282-1	NO CUST COMP			SADA II	Det/Cooler	Receiver Assembly
CW3222280-1	Cooler Knocking	Cooler Knocking.	04/29/2002	SADA II	Det/Cooler	Receiver Assembly
CW3222280-1	Cooler noisy at power up, quiets down around 4.7 min.	Very loud audible noise @ +25c.	04/29/2002	SADA II	Det/Cooler	Receiver Assembly
CW3222280-1	Noisy cooler; shook the test stand	Noisy cooler; shook the test stand	05/24/2002	SADA II	Det/Cooler	Receiver Assembly
CW3222280-1	No FIAR	Unit failed @ -40C; it was very noisy in vertical position.	07/02/2002	SADA II	Det/Cooler	Receiver Assembly
CW3222280-1	TRU failed turn-on Word 5=5 (SADA EEPROM, SADA SERIAL I/O)		04/29/2002	SADA II	Det/Cooler	Receiver Assembly
CW3222280-1	Cool down time exceeded @ -40c.	Cool down time exceeded @ -40c.	04/17/2002	SADA II	Det/Cooler	Receiver Assembly

CW3222280-1	Receiver makes loud noise with multiple cooler cca's.	Receiver makes loud noise with multiple cooler cca's. IBAS needs receiver returned within 45 days.	05/24/2002	SADA II	Det/Cooler	Receiver Assembly
CW3222280-1	Fails due to vertical dark line in video when tap on SADA bench unit fails from vibe lab test.	Fails due to vertical dark line in video when SADA is tapped. Bench unit fails from vibe lab test.	07/02/2002	SADA II	Det/Cooler	Receiver Assembly
CW3222280-1	Unit failed at room temp. Receiver has audible noise after unit had been powered on for over 10 minutes.	Unit failed at room temp. Receiver has audible noise after unit had been powered on for over 10 minutes.	07/02/2002	SADA II	Det/Cooler	Receiver Assembly
CW3222280-1	SADA bad channel	SADA bad channel.	07/02/2002	SADA II	Det/Cooler	Receiver Assembly

CW3222280-1	Tested sada at +22C, cooldown was 00:06:56. After cooldown, bit	No entry saying RIO 1298 failed, therefore, this TRBLSHT entry is used to document the replacement.		SADA II	Det/Cooler	Receiver Assembly
CW3222280-1	fails cooldown time @ +61c	Fails cooldown.	04/29/2002	SADA II	Det/Cooler	Receiver Assembly
CW3222280-1	unit fails part A test.Makes loud audible noise during cooldown.		04/29/2002	SADA II	Det/Cooler	Receiver Assembly
CW3222280-1	Massive Dead Channels.	Massive Dead Channels.	10/22/2001	SADA II	Det/Cooler	Receiver Assembly
CW3222280-1	Causes boresight achieved fail. Scanner mirror sticks to one side when pressed manually.	Causes boresight achieved fail. Scanner mirror sticks to one side when pressed manually.	08/07/2001	SADA II	Det/Cooler	Receiver Assembly
CW3222280-1	Scanner position limits	Scanner position limits.	07/25/2001	SADA II	Det/Cooler	Receiver Assembly
CW3222280-1	A black streak radiating away from white target image.	Black streak radiates away from white target image.	07/02/2002	SADA II	Det/Cooler	Receiver Assembly

CW3222280-1	Fails BS CBIT w4=2, gain & level TEC look like there are oscilla	Fails BS CBIT w4=2, gain & level TEC look like there is oscillation		SADA II	Det/Cooler	Receiver Assembly
CW3222280-1	Unit failed during UT. Failed bkit and SADA bad channels	Unit failed during UT. Failed Bkit and SADA bad channels; cause of fail was the rcvr. Fail occurs 30 mins. into test.	07/16/2002	SADA II	Det/Cooler	Receiver Assembly
CW3222280-1	Fails 1st Test BIT SADA bad channels.		07/02/2002	SADA II	Det/Cooler	Receiver Assembly
CW3222280-1	Cooler makes loud noise @ power-up.	Cooler makes loud noise @ power-up.	05/24/2002	SADA II	Det/Cooler	Receiver Assembly
CW3222280-1	Unit would not cool down.	Unit would not cool down.	07/02/2002	SADA II	Det/Cooler	Receiver Assembly
CW3222280-1	Audible Noise.		08/08/2002	SADA II	Det/Cooler	Receiver Assembly
CW3222280-1	BIT fails, sada bad channels.	BIT fails, sada bad channels.	04/29/2002	SADA II	Det/Cooler	Receiver Assembly

CW3222280-1	Fails SADA bad channels.	Fails SADA bad channels.	04/16/2001	SADA II	Det/Cooler	Receiver Assembly
CW3222280-1	Cooler not centered preventing the receiver from being installed in the TRU housing.	Cooler can not centered preventing the receiver from being installed in the TRU housing.	09/17/2001	SADA II	Det/Cooler	Receiver Assembly
CW3222280-1	Cooler cylinder is located too far past casting housing will not fit into TRU housing	Cooler cylinder located too far past casting housing; won't fit into TRU housing.	09/17/2001	SADA II	Det/Cooler	Receiver Assembly
CW3222280-1	Band of video flashing in the FLIR mode. (Hot temp failure)	Band of video flashing in the FLIR mode. (Hot temp failure)	07/02/2002	SADA II	Det/Cooler	Receiver Assembly
CW3222280-1	Bottom 1/5 th of display has horizontal noise.	Bottom 1/5 th of display has horizontal noise.	04/29/2002	SADA II	Det/Cooler	Receiver Assembly
CW3222280-1	Failed power up voltages	Failed power up voltages.	07/02/2002	SADA II	Det/Cooler	Receiver Assembly

CW3222280-1	SADA serial I/O @ thermal hot 60c.	SADA serial I/O @ thermal hot +60C.	11/14/2001	SADA II	Det/Cooler	Receiver Assembly
CW3222280-1	loud noise from SADA	Loud noise from SADA.	04/29/2002	SADA II	Det/Cooler	Receiver Assembly
CW3222280-1	Failed NFOV to WFOV	Failed NFOV to WFOV alignment (El)	11/16/2001	SADA II	Det/Cooler	Receiver Assembly
CW3222280-1	SADA serial I/O	SADA serial I/O @ -40C.	11/14/2001	SADA II	Det/Cooler	Receiver Assembly
CW3222280-1	BBKIT fail, SGCEU and SAU, SAU fail= BKIT, BKIT fails are TRS2 overheat and SADA bad channels.	BBIT fail, SGCEU and SAU, SAU fail= BKIT, BKIT fails are TRS2 overheat and SADA bad channels.	06/07/2001	SADA II	Det/Cooler	Receiver Assembly
CW3222280-1	TRS2 overheat occured during Offset Verification Test.	TRS2 overheat occurred during Offset Verification Test.		SADA II	Det/Cooler	Receiver Assembly
CW3222280-1	Vertical black lines on video.		04/29/2002	SADA II	Det/Cooler	Receiver Assembly

CW3222280-1	Fails 1st test ambient WFOV rotation elevation ptr-28397, R76403			SADA II	Det/Cooler	Receiver Assembly
CW3222280-1	FLIR mode, distorted video.	FLIR mode, distorted video.	10/22/2001	SADA II	Det/Cooler	Receiver Assembly
CW3222280-1	Fails massive dead channels.	Fails massive dead channels.	04/16/2001	SADA II	Det/Cooler	Receiver Assembly
CW3222280-1	VP BAD TIMING, SADA SERIAL I/O, SADA BAD CHANNELS, REFORMATTE R	VP Bad Timing, SADA Serial I/O, SADA Bad Channels, Reformatter Freeze Frame Input, Digitizer Control Signature and SU Fan.	10/22/2001	SADA II	Det/Cooler	Receiver Assembly
CW3222280-1	Intermittent vertical bars and noisy/dead channels seen in qual system.	Intermittent vertical bars and noisy/dead channels.		SADA II	Det/Cooler	Receiver Assembly
CW3222280-1	Fails visual for noisy channel on line 243 at +25c	Fails visual for noisy channel on line 243 at +25C.	07/02/2002	SADA II	Det/Cooler	Receiver Assembly

CW3222280-1	30HZ AND 60HZ DEAD CHANNELS. TOTAL DEAD CHANNELS @ 30HZ=272.	30HZ AND 60HZ DEAD CHANNELS. TOTAL DEAD CHANNELS @ 30HZ = 272. TOTAL DEAD CHANNELS @ 60HZ = 258.	04/29/2002	SADA II	Det/Cooler	Receiver Assembly
CW3222280-1	NFOV to WFOV alignment.	NFOV to WFOV alignment (EL) @ ambient.	07/02/2002	SADA II	Det/Cooler	Receiver Assembly
CW3222280-1	Fails A.T. RCVR test for audible noise during testing very loud.	Fails A.T. RCVR test for audible noise during testing very loud.	05/24/2002	SADA II	Det/Cooler	Receiver Assembly
CW3222280-1	Fails IBIT (SADA serial I/O; "FLIR FAIL on display)	Fails IBIT Word 2=480, Word 15=20 (SADA serial I/O; "FLIR FAIL on display)	04/29/2002	SADA II	Det/Cooler	Receiver Assembly
CW3222280-1	FAILED FOR COOLING KNOCKING	Failed for cooler knocking.	04/29/2002	SADA II	Det/Cooler	Receiver Assembly

CW3222280-1	Excessive noise; flashing dead channel center of video.			SADA II	Det/Cooler	Receiver Assembly
CW3222280-1	IBIT fail.	IBIT fail. CBIT W2, 480 (SU, Bkit) & W15, 20 (SADA Serial I/O). Int stat W2, 480, W11 4 (same fails).	11/14/2001	SADA II	Det/Cooler	Receiver Assembly
CW3222280-1	Failed to cool down in time during troubleshooting, fails SADA	Failed to cool down in time during troubleshooting, fails SADA serial I/O @ thermal.	11/14/2001	SADA II	Det/Cooler	Receiver Assembly
CW3222280-1	Black shadow radiating from target.. Negative crosstalk.	Black shadow radiating from target. Negative crosstalk (3.2.14.2). Extended source crosstalk, signal inversion (3.2.14.3). (Failed @ AT station.)	11/16/2001	SADA II	Det/Cooler	Receiver Assembly

CW3222280-1	Fails vibe for lost video during positive el. on GAU z axis.	Vib sensitive, causes vertical lines in display.	08/16/2002	SADA II	Det/Cooler	Receiver Assembly
CW3222280-1	FAILS SADA BAD CHANNELS.	SADA bad channels.	07/02/2002	SADA II	Det/Cooler	Receiver Assembly
CW3222280-1	SADA Serial I/O	SADA Serial I/O.	10/22/2001	SADA II	Det/Cooler	Receiver Assembly
CW3222280-1	Tested sada at +23C, cooldown was 00:07:51. Ch 249, 308, 369, &	SU fail.	12/12/2001	SADA II	Det/Cooler	Receiver Assembly
CW3222280-1	Video Sync A,D,& E (Video Static), during VIB testing.		07/03/2002	SADA II	Det/Cooler	Receiver Assembly
CW3222280-1	Fails SADA bad channels.		06/17/2002	SADA II	Det/Cooler	Receiver Assembly
CW3222280-1	Declared bkit fail during offset test-TRS2 overheat & SADA bad channels			SADA II	Det/Cooler	Receiver Assembly

CW3222280-1	Has band of bad video @ +60c. (Hot temp failure).	Has band of bad video @ +60c. (Hot temp failure).		SADA II	Det/Cooler	Receiver Assembly
CW3222280-1	Visual defect-horz. line AT.	Failed at AT; CRT has horiz. line. One channel did not normalize. Visual defect.		SADA II	Det/Cooler	Receiver Assembly
CW3222280-1	Fails PBIT: SADA EEPROM,SADA SERIAL I/O. IBIT: TRS 2 OVERHEAT, SADA SERIAL I/O (room temp failure).	Fails PBIT: SADA EEPROM,SADA Serial I/O. IBIT: TRS 2 Overheat, SADA Serial I/O (room temp failure).	04/29/2002	SADA II	Det/Cooler	Receiver Assembly
CW3222280-1	Fails part A test for cooldown time exceeded 10.5 min. due to Sada did not power up.		04/29/2002	SADA II	Det/Cooler	Receiver Assembly
CW3222280-1	TRS/OVERHEAT +SADA BAD CHANNELS	TRS/Overheat & SADA bad channels.	04/29/2002	SADA II	Det/Cooler	Receiver Assembly
CW3222280-1	SADA serial I/O & cooldown time exceeded.	SADA Serial I/O & cooldown time exceeded @ -40C.	11/14/2001	SADA II	Det/Cooler	Receiver Assembly

CW3222280-1	Fails SADA serial I/O and cooldown time exceeded @ thermal cold -40c.		04/29/2002	SADA II	Det/Cooler	Receiver Assembly
CW3222280-1	Failed bit @ u.t. bit failures were scan error and focus position limits and boresight achieved	FAIL FOCUS POSITION @ IBIT & SU FAIL @ LRAS3 MODE ONLY	04/16/2002	SADA II	Det/Cooler	Receiver Assembly
CW3222280-1	NEGATIVE CROSSTALK, EXTENDED SOURCE CROSSTALK, SIGNAL INVERSION	Negative crosstalk, extended source crosstalk, signal inversion.	12/12/2001	SADA II	Det/Cooler	Receiver Assembly
CW3222280-1	COOLDOWN TIME EXCEEDED	Cooldown time exceeded.	04/29/2002	SADA II	Det/Cooler	Receiver Assembly
CW3222280-1	when switching from TIS mode to b-kit screen goes black with noisy lines across 1/4 th of screen			SADA II	Det/Cooler	Receiver Assembly
CW3222280-1	Visual Image Defect		04/03/2002	SADA II	Det/Cooler	Receiver Assembly

CW3222280-1	TRS/OVERHEAT + SADA BAD CHANNELS	TRS overheat & SADA bad channels.		SADA II	Det/Cooler	Receiver Assembly
CW3222280-1	Fails TRS/overheat + SADA bad channels @ vibration.		07/03/2002	SADA II	Det/Cooler	Receiver Assembly
CW3222280-1	VIDEO SYNC E THEN LOCKED UP IN BIT	Video sync E, then locked up in BIT.		SADA II	Det/Cooler	Receiver Assembly
CW3222280-1	Bkit su sada bad channels	Bkit SU SADA bad channels.	07/16/2002	SADA II	Det/Cooler	Receiver Assembly
CW3222280-1	TRS/OVERHEAT +DISTORTED VIDEO	TRS overheat & distorted video.		SADA II	Det/Cooler	Receiver Assembly
CW3222280-1	Fails TRS overheat @ 1st test ambient		04/29/2002	SADA II	Det/Cooler	Receiver Assembly
CW3222280-1	Has horizontal scan jitter.		04/03/2002	SADA II	Det/Cooler	Receiver Assembly
CW3222280-1	Bad band of video in middle of screen.			SADA II	Det/Cooler	Receiver Assembly

CW3222280-1	Fails SADA serial I/O, SADA EEproxy TRS2 temp sensor @ HOT (60)		04/29/2002	SADA II	Det/Cooler	Receiver Assembly
CW3222280-1	WON'T COOLDOWN	Won't cooldown.	04/29/2002	SADA II	Det/Cooler	Receiver Assembly
CW3222280-1	INTERMITTANT FLASHING BAND OF VIDEO IN TOP 1/3 OF SCREEN.	Intermittent flashing band of video in top 1/3 of screen.		SADA II	Det/Cooler	Receiver Assembly
CW3222280-1	Bad band of video in top half of screen.		04/17/2002	SADA II	Det/Cooler	Receiver Assembly
CW3222280-1	Noise lines in FLIR mode. Lines are in horizontal plane.		04/29/2002	SADA II	Det/Cooler	Receiver Assembly
CW3222280-1	FLIR video moves from side to side. Scanner needs realigned.			SADA II	Det/Cooler	Receiver Assembly

CW3222280-1	SADA serial I/O	SADA serial I/O, CC. PSA lab test found defective flasher in the center 10 channel range on Ch 238 (frame grabber = 3.1 std dev) and cooldown was 00:09:39. (At +65C.)	04/29/2002	SADA II	Det/Cooler	Receiver Assembly
CW3222280-1	Fails SADA serial I/O @ cold hot -40 - 60c	Fails SADA serial I/O @ -40c & + 60c.	04/29/2002	SADA II	Det/Cooler	Receiver Assembly
CW3222280-1	Intermittent band of noise across FLIR video image missing o-ring.		07/16/2002	SADA II	Det/Cooler	Receiver Assembly

CW3222280-1	SADA has intermittent power cycles during cool down causing occasional intermittent noise.	SADA has intermittent power cycles during cool down causing occasional intermittent noise. Rcvr: AT complete... 1/25/02; Rtn CRM... 2/26/02.	05/24/2002	SADA II	Det/Cooler	Receiver Assembly
CW3222280-1	Fails FLIR fail + would not cooldown @ 1st test ambient		04/17/2002	SADA II	Det/Cooler	Receiver Assembly
CW3222280-1	Cooler knocking @ turn-on. Replace w/ 52649		08/08/2002	SADA II	Det/Cooler	Receiver Assembly
CW3222280-1	Fails 1st test ambient will not cooldown.		04/29/2002	SADA II	Det/Cooler	Receiver Assembly
CR3222280-1	Will not cooldown @ 1st test ambient.		08/16/2002	SADA II	Det/Cooler	Receiver Assembly

CW3222282-1	Will not cooldown	Will not cooldown.	07/02/2002	SADA II	Det/Cooler	Receiver Assembly
CW3222282-1	has flashing lines @ 265, 257, and 258	Has flashing lines @ 265, 257, and 258.	08/07/2001	SADA II	Det/Cooler	Receiver Assembly
CW3222282-1	Noisy cooler	Noisy cooler 5 minutes after turn-on	05/24/2002	SADA II	Det/Cooler	Receiver Assembly
CW3222282-1	No cust. comp	FAIL BKIT, FAIL TRS2 OVERHEAT @ POWER ON, 25c temp.	04/29/2002	SADA II	Det/Cooler	Receiver Assembly
CW3240063-2	Failure indication of failed digitizer and scan.	"Failure indication of failed digitizer and scan" CCAs.	07/02/2002	SADA II	Det/Cooler	Receiver Assembly
C3222280-0001	Failed leak test. Receiver assy leaking around bottom indicated by red arrows.	Failed leak test. Receiver assy leaking around bottom indicated by red arrows.	07/02/2002	SADA II	Det/Cooler	Receiver Assembly
CR1917100-1	Very noisy & knocking	Very noisy & knocking.	10/12/2001	SADA II	Det/Cooler	Receiver Assembly

CR3222280-1	Unit fails to cooldown to operating temp.		04/29/2002	SADA II	Det/Cooler	Receiver Assembly
CR3222282-1	NO CUST COMP	ncc, NOISY SADA.	04/29/2002	SADA II	Det/Cooler	Receiver Assembly
CR3222282-1	No cust. comp	White lines on channels 242 - 246 @ 60HZ ONLY , @ +25c.	04/22/2002	SADA II	Det/Cooler	Receiver Assembly
CW3222280-1	Failed wide field of view (Rotation EL)	Failed wide field of view (Rotation EL).	07/02/2002	SADA II	Det/Cooler	Receiver Assembly

C3222280-0001	B-kit receiver has loud audible noise.	Tested on part B Bkit plate @ room temp using low power cooler control CCA MSN 2570. Ran UT in PSA lab w/hi power cooler CCA; tested @ +22C, +65C, & -40C w/low and high power CCA. Exhibited no noise; CND customer complaint. Discussed testing separately w/James Ingram & Hector Reyes; no additional testing justified. 2/21/00 jw	05/23/2000	SADA II	Det/Cooler	Receiver Assembly
CW3222280-1	Unit has noisy video in wfov at X2 zoom also in nfov mode	Unit has noisy video in wfov at X2 zoom also in nfov	04/29/2002	SADA II	Det/Cooler	Receiver Assembly

	nfov mode.	also in nfov mode.				
CW3240063-2	Noise		04/29/2002	SADA II	Det/Cooler	Receiver Assembly
CW3240063-2	Screen has black line all thru.		07/02/2002	SADA II	Det/Cooler	Receiver Assembly
CW3240063-2	band of dead channels(422 thru 480) fails missing lines spec			SADA II	Det/Cooler	Receiver Assembly
CW3263958-1	UUT cooldown time exceeded.			SADA II	Det/Cooler	Receiver Assembly
CW3263958-1	Fails when starting, warm during cooldown causes a loud knocking noise @ 1st test ambient.			SADA II	Det/Cooler	Receiver Assembly
CW3222280-1	No cust. comp	ncc, FAIL TRS 2 OVERHEAT	04/29/2002	SADA II	Det/Cooler	Receiver Assembly
CW3222280-1	Fails will not cool down @ 1st test ambient.		08/16/2002	SADA II	Det/Cooler	Receiver Assembly

CW3222281-1	Rcvr has no video when running part A test.	Rcvr has no video when running part A test.	07/02/2002	SADA II	Det/Cooler	Receiver Assembly
CW3222280-1	BIT flag. Word 17=1801. Many bad channels in video.		07/16/2002	SADA II	Det/Cooler	Receiver Assembly
CW3222280-1	Packing material (loose) migrated throughout unit. Unit was shipped from France after demonstration @ show.		08/23/2002	SADA II	Det/Cooler	Receiver Assembly
CW3222280-1	Fails SADA EEPROM @ thermal cold -40c.		05/21/2002	SADA II	Det/Cooler	Receiver Assembly
CW3222280-1	No FLIR video, sau, sgceu fails, bkit trs2 overheat and sada serial i/o.			SADA II	Det/Cooler	Receiver Assembly
CW3222282-1	No Cust. Comp	ncc, Fail cooldown monitor & trs2 overheat.	04/29/2002	SADA II	Det/Cooler	Receiver Assembly

CW3222282-1	Loud noise emmiting from Target Aquisition system when Turret is on and system is cooling.	Loud noise emitting from Target Aquisition system when Turret is on and system is cooling.	04/29/2002	SADA II	Det/Cooler	Receiver Assembly
CW3240063-2	FAILS DESETS 11296		04/29/2002	SADA II	Det/Cooler	Receiver Assembly
CW3240063-2	HAS THE 1553 FED BACK THERMAL FAIL			SADA II	Det/Cooler	Receiver Assembly
CW3240063-2	gives bit failure. Cooler input			SADA II	Det/Cooler	Receiver Assembly
CW3263958-1	UUT cooldown time exceeded.			SADA II	Det/Cooler	Receiver Assembly
CW3263958-1	UUT cooldown time exceeded.			SADA II	Det/Cooler	Receiver Assembly
CW3263958-1	Cooler knocking in bi @ -32c.			SADA II	Det/Cooler	Receiver Assembly
CW3222280-1	Leaks severely seems to be coming from more than 1 place.	Leaks severely; seem to be coming from more than 1 place.	11/14/2001	O-ring	Det/Cooler	Receiver Assembly

CW3222280-1	Fails in process inspection, missing O'ring.	Fails in process inspection, missing o-ring.	08/07/2001	O-ring	Det/Cooler	Receiver Assembly
CW3222280-1	Before installation found bent pin on db/78 connector, and missing captive screw on flange.		06/14/2002	Dewar flex assy	Det/Cooler	Receiver Assembly
CW3222280-1	GAU looses video when slewing in EL.	GAU looses video when slewing in EL.		Dewar flex assy	Det/Cooler	Receiver Assembly
CR3222280-1	Pin 19 on W1P3 connector on the dewer flex is broke.	Pin 19 on W1P3 connector on the dewar flex is broke. AFD 7/11/01.	06/14/2002	Dewar flex assy	Det/Cooler	Receiver Assembly
C3222280-0001	Damaged heat dissipating pin broken off. (Received in box damaged).	Damaged heat dissipating pin broken off. (Received in box damaged).. Reliability note: Note 11 of dwg 3224148-1 allows one	05/23/2000	Det/Cooler	Det/Cooler	Receiver Assembly

		broken pin per/sq inch.				
CW3222282-1	IBAS had horizontal lines in video which distorted the field of		06/12/2002	Det/Cooler	Det/Cooler	Receiver Assembly
CW3222282-1	NO CUST COMP			Det/Cooler	Det/Cooler	Receiver Assembly
C3222280-0001	Receiver kitted with defective cooler clamp 3224148-1. 3 broken pins found right out of the box.			Cooler clamp	Det/Cooler	Receiver Assembly
CW3222280-1	Cooler heatsink has 2 broken adjacent cooling pins.	Cooler heatsink has 2 broken adjacent cooling pins.	05/10/2001	Cooler clamp	Det/Cooler	Receiver Assembly

CR3222280-1	Cooler Clamp has several pin broken and do not meet spec.		07/23/2002	Cooler clamp	Det/Cooler	Receiver Assembly
C3222280-0001	BKIT blacks out after about 10 minutes of use.	BKIT blacks out after about 10 minutes of use. Filter wheel motor measured 11.1 Kohms. (CIV)	10/11/2001	Cooler cable	Det/Cooler	Receiver Assembly
CW3222280-1	testedfor customer complaint/could not verify failure, tested@23C=bit fail @ power up for cooler compress temp sensor		06/12/2002	Cooler cable	Det/Cooler	Receiver Assembly
C3222280-0001	TRU 313 failed leak test (receiver assy "EMI feedthru" leaking.)	11/7/00: HTI RMR Parts Replacement Req showed potting @ flange leaked @ the side joint near P1. 12/6/00: Rcvr completed vib	12/12/2001	Cooler cable	Det/Cooler	Receiver Assembly

		11/20/00 and BI 11/29/00.				

C3222280-0001	No FIAR; DRS-PB. 9/13/00, per D. Hardenbrook: This failed EMI feedthru leak.	11/7/00: HTI RMR Parts Replacement Req showed potting @ flange leaked @ the top joint with the flange and at the side joint near J1; this is not the flatness problem as believed from the 10/25/00 discussion w/Brad: On the flatness issue, Raytheon was screening those for a good seal and discussed the problem with the vendor so they ship only units which don't have this defect. [Per David Hardenbrook	12/12/2001	Cooler cable	Det/Cooler	Receiver Assembly

		9/13/00: This fail is an O-ring fail (EMI feedthru leak). Four rcvrs @ DRS had damaged o-rings. Two 0-rings were shipped & DRS replaced them; they returned the other two to Raytheon.] 12/6/00: Completed vib 11/20/00 & BI 11/29/00 after cooler cable replaced.				
CW3222280-1	SU fail	SU fail	05/30/2002	Cooler cable	Det/Cooler	Receiver Assembly

CW3222280-1	Fails cooler\compress temp @+25			Cooler cable	Det/Cooler	Receiver Assembly
CW3222280-1	FAILS LEAK TEST	Fails leak test.		Cooler cable	Det/Cooler	Receiver Assembly
CW3222280-1	FAILED NO COOLDOWN	Failed, no cooldown.	06/12/2002	Cooler cable	Det/Cooler	Receiver Assembly
CW3222280-1	Fail FOV position sada bad channels after vibration.		07/03/2002	Cooler cable	Det/Cooler	Receiver Assembly
CW3222280-1	Fail leak check. Pan head screw is missing 1pl. marked the area.			Cooler cable	Det/Cooler	Receiver Assembly
CW3222280-1	Fails WFOV (Rotation EL) @ 1st test ambient.	Fails WFOV (Rotation EL) @ 1st test ambient. Previous failure ref. DMR 17286. MIL-PRF-A3207380, Rev A, para. 3.2.6.5 Image rotation. Fail +10.5 mrad vertical line requirement (measured 12.1 mrad.)		Cooler cable	Det/Cooler	Receiver Assembly

CW3222280-1	Failed to cooldown @ 1st test ambient (would not cooldown temp0.00	Failed to cooldown @ 1st test ambient (would not cooldown temp 0.0).	11/16/2001	Connector, 78 pin	Det/Cooler	Receiver Assembly
CW3263961-1	Wrong card lock will not assemble.			Retainer	Digitizer CCA	Digitizer CCA
CW3263961-2	Failed vibe for sbit/nbit sgceu & sau=sgceu. BBIT=sgceu bkit			RETAINER	Digitizer CCA	Digitizer CCA
CR3222288-1	CCA has a bad video band, evident on all LRU configurations. CCA was the "problem" CCA when the CIV-SAU failed normalization. This was repeatable.	Bad video band, evident on all LRU configurations.		RESISTOR (.75 KOH	Digitizer CCA	Digitizer CCA
CW3222288-1	Video flickers on and off.	Video flickers on and off.	02/15/2002	Resistor	Digitizer CCA	Digitizer CCA

CW3222288-1	No FIAR till 3/21. Failed @ hot, +60C: afocal temp 0.0, didn't start BIT as commanded 10 times; failed to cooldown, failed scanner motor high and low.	Failed @ hot, +60C: afocal temp 0.0, didn't start BIT as commanded 10 times; failed to cooldown. When tested @ cold, failed scanner motor high and low.	08/07/2001	Oscillator 59.40	Digitizer CCA	Digitizer CCA
CW3263961-1	WRONG CARD GUIDE/LOCKS, WILL NOT ASSEMBLE	Wrong card guide/locks, will not assemble.	04/12/2002	Retainer	Digitizer CCA	Digitizer CCA

CR3222288-1	Fails consistently in configurations.	Fails consistently in TIS-SGTRU and CITV-SGSA configurations. Fails Test Pattern 4 in 60 Hz Thermal Mode. Following signals are verified: Digital video clock in 60 Hz mode @ 29.704 MHz, Column Sync @ 1360 counts, Digital ID0 @ 60 Hz, Digital ID1 @ 60 Hz. Mailbox 33 is updated to select Test Pattern 4 and CCA fails during data analysis against Test Pattern 4 data.		IC,TTL to PECL	Digitizer CCA	Digitizer CCA
CW3222288-1	Failed GenRad test after system 1103 "smoked". Per customer troublesheet, "EU had 28V input power applied reversed."	Failed GenRad test after IBAS system 1103 "smoked". Per IBAS T/S, "EU had 28V input power applied	07/16/2002	IC,TTL to PECL	Digitizer CCA	Digitizer CCA

		reversed."				
CW3222288-1	CCA causes TRU to hang up in gray scale.			IC,TTL to PECL	Digitizer CCA	Digitizer CCA
CW3222288-1	Multiple BIT failures. Vertical & horizontal lines, video wobbles, FOV afocal failure.	Multiple BIT failures. Vertical & horizontal lines throughout raster, video wobbles, FOV afocal failure.		IC,TTL to PECL	Digitizer CCA	Digitizer CCA
CW3222288-1	TRS sums and VP vertical direction, Globalization/Polarity, VP1 control signature, SU fail ambient.	TRS sums and VP vertical direction, Globalization/ Polarity, VP1 control signature, SU fail ambient.	06/28/2001	IC,TTL to PECL	Digitizer CCA	Digitizer CCA
CW3222288-1	VP bad timing and SADA I/O failure just seconds into vibe.	VP bad timing and SADA I/O failure just seconds into z-axis GAU vib.	06/11/2002	IC, PAL	Digitizer CCA	Digitizer CCA

CW3222288-1	Causes FLIR fail		06/11/2002	IC, PAL	Digitizer CCA	Digitizer CCA
CW3222288-1	Lost flir video after system ran for about 5 min in z-axis vibe.	Lost FLIR video after system ran for ~5 minutes in z-axis vibe.	06/11/2002	IC, PAL	Digitizer CCA	Digitizer CCA
CW3222288-1	Fails vibe, FLIR video breaks up, b-kit VP bad timing, reformatter freeze input cca has video failure w/o v.6.	Fails vibe, FLIR video breaks up, b-kit VP bad timing, reformatter freeze input CCA has video failure w/o software V. 6.	06/11/2002	IC, PAL	Digitizer CCA	Digitizer CCA
CW3222288-1	AR28 has physical damage. The encapsulated lid popped off the PECL driver.	AR28 has physical damage. The encapsulated lid popped off the PECL driver. [Rel. note: AR28 is an op amp, not a PECL.]		IC, Op amp	Digitizer CCA	Digitizer CCA

CW3263961-1	Fails reformatter freeze frame input UP1 control signature and never completed BIT @ HOT1 40c.	Fails reformatter freeze frame input VP1 control signature and never completed BIT @ HOT1 40c.	02/19/2002	IC, PAL	Digitizer CCA	Digitizer CCA
CW3263961-1	Fails in system 5307 & SAU 5311 @ -32c Dig. serial I/O BKIT BIT fail.			IC, PAL	Digitizer CCA	Digitizer CCA

CW3222288-1	After about 3 hrs of 1.0 x vertical profile V07 vibration, the FLIR video had vertical flashing in the display. Power was cycled and the BKIT would not initialize.	After about 3 hrs of 1.0 x vertical profile V07 vibration, the FLIR video had vertical flashing in the display. Power was cycled and the BKIT would not initialize @ vib. During CIV troubleshooting, BIT was completed after multiple tries with fails: VP bad timing, Reformatter Freeze Frame input, SADA EEPROM, SADA Serial I/O, & Digitizer control signature. Fail was double verified by reinstalling 1166 after a different CCA indicated correct operation. CIV had HTI test the CCA. No fails in CIV mode, but fails in TIS mode: VP bad timing, Reformatter Freeze Frame input, SADA Serial I/O. Digitizer then returned as CRM.		IC FPGA XC1040	Digitizer CCA	Digitizer CCA
CW3222288-1	NO FIAR	NO FIAR.	08/07/2001	IC CLC502 Op amp	Digitizer CCA	Digitizer CCA

CW3222288-1	Fails BIT - SADA bad channels.	Fails BIT- SADA bad channels (in TRU 269).	08/07/2001	IC CLC502 Op amp	Digitizer CCA	Digitizer CCA
CW3222288-1	FLIR video had 2 1/4 wide bands located 1/4 from top of video to center & the other located 3/4 from bottom to center at rm hot & cold temps.	FLIR video had 2 1/4 wide bands located 1/4 from top of video to center & the other located 3/4 from bottom to center at rm hot & cold temps.		IC AD872 ASD/883	Digitizer CCA	Digitizer CCA
CW3222288-1	Noisy video.		06/17/2002	IC AD872 ASD/883	Digitizer CCA	Digitizer CCA
C3222288-0001	replace U16 pn 3222354-1.rwp9612			Digitizer CCA	Digitizer CCA	Digitizer CCA
C3222288-0001	rerplace U16, 3222354-1, save part.rwp9612			Digitizer CCA	Digitizer CCA	Digitizer CCA
C3222288-0001	replace U41, save part			Digitizer CCA	Digitizer CCA	Digitizer CCA
CR3222288-1	No cust. comp		05/13/2002	Digitizer CCA	Digitizer CCA	Digitizer CCA
CR3222288-1	No cust. comp			Digitizer CCA	Digitizer CCA	Digitizer CCA

CR3222288-1	Failed DESETS	Failed DSESTS.		Digitizer CCA	Digitizer CCA	Digitizer CCA
CR3222288-1	B-KIT and SAU fail, SADA EEPROM			Digitizer CCA	Digitizer CCA	Digitizer CCA
CW3222288-1	No Cust. Comp			Digitizer CCA	Digitizer CCA	Digitizer CCA
CR3222288-1	No cust. comp.			Digitizer CCA	Digitizer CCA	Digitizer CCA
CR3222288-1	No cust comp			Digitizer CCA	Digitizer CCA	Digitizer CCA
CW3222288-1	5.920 (+)(-) .010 is 5.936	5.920 (+)(-) .010 is 5.936.	08/07/2001	Digitizer CCA	Digitizer CCA	Digitizer CCA
CW3222288-1	Noise video.	Noisy video.		Digitizer CCA	Digitizer CCA	Digitizer CCA
CW3222288-1	Failed during vibe, flir video breaks up, b-kit bit flags	Failed during vibe; FLIR video breaks up, B-kit BIT flags (z-axis CVU vibe).	07/24/2001	Digitizer CCA	Digitizer CCA	Digitizer CCA
CW3222288-1	All video had horizontal lines running through it. Also had SADA bad channels.		05/13/2002	Digitizer CCA	Digitizer CCA	Digitizer CCA

CW3222288-1	No Cust Comp			Digitizer CCA	Digitizer CCA	Digitizer CCA
CW3222288-1	No cust. comp		06/12/2002	Digitizer CCA	Digitizer CCA	Digitizer CCA
CW3222288-1	NO FIAR	NO FIAR.	12/12/2001	Digitizer CCA	Digitizer CCA	Digitizer CCA
CW3240063-2	Bank 16 outputs dead@ambient			Digitizer CCA	Digitizer CCA	Digitizer CCA
CW3240063-2	Picture has dark horizontal lines (noise)		07/02/2002	Digitizer CCA	Digitizer CCA	Digitizer CCA
CW3263961-1	Vertical bars move across display during vibe; video flickers.	Vertical bars move across display during vibe; video flickers.	06/12/2002	Digitizer CCA	Digitizer CCA	Digitizer CCA
CW3222288-1	5.920 (+)(-) 010 is 5.944	5.920 (+)(-) 010 is 5.944.	08/07/2001	Digitizer CCA	Digitizer CCA	Digitizer CCA
CW3240063-2	Bands of horizontal noise throughout video.		07/16/2002	Digitizer CCA	Digitizer CCA	Digitizer CCA

CW3263961-1	Digitizer cca found not a latest rev. Latest rev contains blue wires and dead-bugged resistors.	Digitizer CCA found not at latest revision since latest revision contains blue wires and dead-bugged resistors.	10/12/2001	Digitizer CCA	Digitizer CCA	Digitizer CCA
CW3263961-1	Needs mod to latest Rev.	Needs mod to latest Rev.	10/12/2001	Digitizer CCA	Digitizer CCA	Digitizer CCA
CW3263961-1	Unit fails in LRAS3 system with no day tv.	Unit fails in LRAS3 system with no day tv.	10/12/2001	Digitizer CCA	Digitizer CCA	Digitizer CCA
CW3263961-1	No FIAR	SADA Serial I/O EPROM (symptom writeup found in box by logistics.)	10/12/2001	Digitizer CCA	Digitizer CCA	Digitizer CCA
CW3263961-1	Replace BKIT flag peformatter freeze frame (needs blue wire mod)	Bkit flag reformatter freeze frame (needs blue wire mod).	10/12/2001	Digitizer CCA	Digitizer CCA	Digitizer CCA
CW3263961-1	Noise video	Noisy video.	03/18/2002	Digitizer CCA	Digitizer CCA	Digitizer CCA
CW3263961-1	No cust. comp		10/12/2001	Digitizer CCA	Digitizer CCA	Digitizer CCA

CW3263961-1	Fails IBIT status verification description IBIT test results word5 and (5/8) digitizer serial I/O.	Fails IBIT status verification description IBIT test results word5 and (5/8) digitizer serial I/O.	03/18/2002	Digitizer CCA	Digitizer CCA	Digitizer CCA
CW3263961-2	Globalization polarity / 2D filter fail @ +60c.	Globalization polarity / 2D filter fail @ +60c.		Digitizer CCA	Digitizer CCA	Digitizer CCA
CW3263961-2	FLIR fail. BIT fails=SAU,BKIT= EU/SU serial link timeout, VP timing, ref. freezeframe input, TRS1 overvolt.			Digitizer CCA	Digitizer CCA	Digitizer CCA
CW3263961-2	SAU, SGCEU, BKIT-GLOBALIZATION/POLARITY, TRS SUMS VP VERTICAL DIR.			Digitizer CCA	Digitizer CCA	Digitizer CCA
CW3263961-1	STTO Impedance			(RPL)CAPACITOR	Digitizer CCA	Digitizer CCA

CW3263958-1	Cooldown time exceeded which causes unit to start knocking @ thermal cold - 40c.	Cooldown time exceeded which causes unit to start knocking @ thermal cold - 40C.	12/12/2001	Cooler CCA	Cooler CCA	Cooler CCA
CW3263958-1	Fails thermal cold - 40c - UUT cool down time exceeded.	Exceeds cool down time @ -40c.		Cooler CCA	Cooler CCA	Cooler CCA
CW3263958-1	Failed cold UUT cooldown time exceeded then failed hot ambient SU fan.			Cooler CCA	Cooler CCA	Cooler CCA
CW3263958-1	Failed cooldown @ cold -40c.	Failed cooldown @ cold -40C.	09/05/2001	Cooler CCA	Cooler CCA	Cooler CCA

C3240063-0002	51025 fails due to being noisy squeals when running also fails DSETS.	3 11/1/00 chains: (1) AFOCAL GIVES FOV POSITION BIT FAIL, (2) CAUSES COOLER TO BE LOUD(NOISY), (3) HEADMIRROR ONLY MOVES 5 TO 20 DEGS. PN 3240072-0001. J1 CONNECTOR HITTING MIRROR. REWORKED CONNECTOR. Troublesheet for 3240072-1, MSN 51174 notes "Gyro shaft hitting on J1 connector (tilted) - rework & retorque	01/24/2001	Resistor	Cooler CCA	Cooler CCA

		connector" for 10/31/00. 11/28/00: Re: (2), cooler CCA SFC C3222296-2267-01 created with PWBA77847 recorded as the non-conformance after removal from Sight 51025; PWBA77847 shows "Failed MPWR1 & 2 indicator test and cooled indicator test. Replaced R61, R62, R63 ("wrong part"; all 0808112-261 part numbers) 12/20/00. However, these 3 resistors did not cause the				

		noise. Revs G (ECN 50055), H (ECN E81580), & J (ECN RW06967) incorporated." These lowered the power delivered to the CCA and fixed the noise problem; however, the resistors did not actually fail. Cooler CCA 2267 re-installed in sight 51025. Afocal 3228326-1 MSN 501 replaced w/production afocal 893 per Chuck Dillow.				
CW3222296-1	RTI component lead broken.	RT1 component lead broken.	08/07/2001	Resistor	Cooler CCA	Cooler CCA

CW3263958-1	Fails cooldown.	Fails cooldown.		Inductor	Cooler CCA	Cooler CCA
CR3222300-1	Fails BIT	Fails globalization/polarity, TRS sums/VP vertical direction, VP1 control signal.		IC, PECL to TTL	Cooler CCA	Cooler CCA
CW3222296-1	Failed @ Cold -40c and at ambient, would not cooldown.	Failed @ Cold -40c and at ambient, would not cooldown.		IC 54HC74	Cooler CCA	Cooler CCA
CW3222296-1	Unit would not cool down fails BIT TRU status fail,status fail 8 TRS overheat.	Unit would not cool down. Fails BIT: TRU status fail, TIS status fail, & TRS overheat. Previous failure for same symptoms. Reference DRS DMR17256.	09/20/2001	IC 54HC74	Cooler CCA	Cooler CCA
CW3263958-1	Failed cooldown @ cold -40c	Failed cooldown @ cold -40C.	08/28/2001	Cooler CCA	Cooler CCA	Cooler CCA

CW3263958-1	No Cust. Comp	Lost cooldown B-KIT, SU fail word 2 = 480 cooldown monitor and TRS2 overheat 1329. (Engineering test in BI - HOT)	04/03/2002	Cooler CCA	Cooler CCA	Cooler CCA
CR3222296-1	Unit powered up in reverse visable damage to board.			Cooler CCA	Cooler CCA	Cooler CCA
CR3222296-1	No Cust. Comp		04/17/2002	Cooler CCA	Cooler CCA	Cooler CCA
CR3222296-1	FAILED DESETS		04/03/2002	Cooler CCA	Cooler CCA	Cooler CCA
CR3222296-1	FAILED DESETS		04/03/2002	Cooler CCA	Cooler CCA	Cooler CCA

CW3222296-1	Fails STTO 28v cooler to rtn is open.	Fails STTO: 28v cooler to rtn is open & rtn to -15 VDC is 3436 ohms but s.b. 4000 ohms @ room temp unit test.	06/20/2001	Cooler CCA	Cooler CCA	Cooler CCA
CW3222296-1	FAILS NETD IN IBAS QUAL SYSTEM.	Failed NETD.	11/14/2001	Cooler CCA	Cooler CCA	Cooler CCA
CW3222296-1	Bad cooler cca. Received in cannabalized unit.			Cooler CCA	Cooler CCA	Cooler CCA
CW3222296-1	CCA suspect caused intermittent Flir failures during qualification testing.	CCA suspect caused intermittent FLIR failures during qualification testing.	08/28/2001	Cooler CCA	Cooler CCA	Cooler CCA
CW3222296-1	BKIT fail, cooldown monitor fail.	Failed SGCEU, SAU, BKit SU; Cooldown Monitor fail. "Not Cool" icon stays illuminated when FLIR image is displayed.	06/20/2001	Cooler CCA	Cooler CCA	Cooler CCA

CW3222296-1	NO CUST. COMP		04/03/2002	Cooler CCA	Cooler CCA	Cooler CCA
CW3222296-1	Failed cooldown monitor, cooler input power.	Failed cooldown monitor, cooler input power.		Cooler CCA	Cooler CCA	Cooler CCA
CR3222296-1	No Cust. Comp	Fails MPWR1, MPWR2, & COOLED INDICATOR TESTS @ Genrad 11		Cooler CCA	Cooler CCA	Cooler CCA
CR3222296-1	Slave TRU #1 fails for cooler input power			Cooler CCA	Cooler CCA	Cooler CCA
CW3263958-1	FLIR will not cooldown, @ -46 (cold temp failure).	FLIR will not cooldown, @ -46 (cold temp failure).	12/13/2001	Cooler CCA	Cooler CCA	Cooler CCA
CW3263958-1	Sight failed cooldown b-kit error.	Sight failed cooldown B-kit error.	09/05/2001	Cooler CCA	Cooler CCA	Cooler CCA
CW3263958-1	Cooler will not cool.			Cooler CCA	Cooler CCA	Cooler CCA
CW3263958-1	Fails UUT cooldown time exceeded @ -40.			Cooler CCA	Cooler CCA	Cooler CCA
CW3263958-1	Broken part to right of conn. P/n 199649285 on bottom		02/28/2002	Capacitor, tantalum	Cooler CCA	Cooler CCA

CW3222296-1	FLIR will not cooldown. Capacitor on CCA broken.	FLIR will not cooldown. Capacitor on CCA broken.	07/10/2001	Capacitor	Cooler CCA	Cooler CCA
CW3222296-1	No cooldown.	No cooldown.	08/07/2001	Capacitor	Cooler CCA	Cooler CCA
C3240063-0002	Screen whites out when gun fires.	11/8/00 Chain: "GIVES FOV POSITION BIT FAIL" and 3228326-0001 (afocal) is listed as failed. Removed afocal 842 for repair or replacement. Simulated flash - no TRS response to rapid saturation - CND white out. Used SEU 51239 for vibe test.	01/19/2001	Afocal Assy	Afocal Assy	Afocal Assy
CW3240063-2	Afocal will not change field of view.	Afocal will not change field of view.	07/09/2002	Afocal Assy	Afocal Assy	Afocal Assy

CW3240063-2	Causes CITV fault codes 3/0 and 15/6, focus position and focus		04/03/2002	Afocal Assy	Afocal Assy	Afocal Assy
CW3240063-2	When powered up sets void 10 bit 7 = FOV position limits.			Afocal Assy	Afocal Assy	Afocal Assy

APPENDIX E

On-Going Qualification Test Failure Data

B-Kit Failures in OMNI RGT as of 10/10/02

B-Kit Assembly	Number of fails	Symptom
SGCEU	1	I/F CCA loose
SGCEU	1	No FLIR communications
TBD (fail under investigation)	1	FOV Position BIT flag
TBD (fail under investigation)	1	Focus Position BIT flag
TBD (fail under investigation)	1	PS1 Undervoltage BIT flag
TBD (fail under investigation)	1	Filter Wheel Current, Filter Wheel Position, Stationary Filter Wheel Voltage, SADA Bad Channels BIT flags
Total	6	