THE PROs AND CONs OF THE USE OF NDI SOFTWARE ON GOVERNMENT CONTRACTS

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ABSTRACT

The application of NDI is becoming more wide spread, especially with the development of better software development methodologies, such as Object Oriented techniques, and languages, such as Ada. Contractor's who have a substantial quantity of NDI software for a specific application; for example, flight simulation, radar simulation, etc., maintain a significant advantage over those who do not when responding to a Request For Proposal from the Government. Their cost can be substantially lower than others and thus provide the contractor with the most available NDI software for the required application, an "easy" win.

Unfortunately, the Government's definition of NDI continues to baffle many as to exactly what qualifies as NDI. This typically leads to long and generally somewhat unresolved battles between program managers and engineers on both sides following the award of the contract. Typically the contractor may have a difficult time qualifying his perceived NDI software as NDI software. Also, the Government still requires a substantial degree of design, performance, implementation, and testing information relating to the NDI.

ABOUT THE AUTHORS

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INTRODUCTION

The use of nondevelopmental item (NDI) software on Government contracts may seem straightforward. The Government can save money, schedule and obtain a more reliable product in the process. The contractor can be more competitive by having a product on the shelf that their competitors do not possess. There are many problems, however, which present themselves when NDI software is used on a Government contract.

o Often the Government and the contractor do not agree as to what qualifies as NDI software.

o There are often differences of opinion as to the level of documentation that should be provided with NDI software.

o There are disagreements as to what rights the contractor keeps and what rights the Government inherits with the NDI software.

These issues have led to many heated discussions on Government contracts. One of the main causes of these differences of opinion is that the definition of NDI software is too vague; thus, the contractor often assumes that almost any piece of software developed using their money can qualify as NDI. Government representatives, however, do not always agree with the contractor's declaration that a certain piece of software is NDI.

This paper does not intend to conclude whether NDI software should be encouraged within the Government procurement process. The Government has already decided that NDI software is to be an integral part of its procurement philosophy. The authors are completely in favor of using NDI software in Government procurement; however, there are many problems that occur with the use of NDI software. Before the advantages and the problems of using NDI software are discussed, it is necessary to examine the existing definition of NDI software.

DEFINITIONS OF NDI SOFTWARE

Government definition. There are three definitions for NDI software found in the following Government documents:

DOD-STD-2167A
MIL-STD-973
MIL-STD-480B

DOD-STD-2167A. In this Department of Defense (DoD) standard, the Government defines nondevelopmental software (NDS), which is the same as NDI software, as follows:

"Deliverable software that is not developed under the contract but is provided by the contractor, the Government, or a third party. NDS may be referred to as reusable software, Government furnished software, or commercially available software, depending on its source."

MIL-STD-973. In this standard, the Government defines nondevelopmental items as follows:

"Non-developmental item is a broad generic term that covers material available from a wide variety of sources with little or no development effort required by the Government. NDIs include:

a. Items obtained from a domestic or foreign commercial marketplace.

b. Items already developed and in use by the Services, other defense activities, and Government agencies.

c. Items already developed by foreign governments which can be supplied in accordance with mutual defense cooperation agreements and Federal and DoD acquisition regulations. (SD-2)"

MIL-STD-480B. This standard defines nondevelopmental items as follows:

"Non-developmental items are existing developed and available hardware or software that are capable of fulfilling DoD requirements, thereby minimizing or eliminating the need for costly, Government-sponsored research and development (R&D)programs. An NDI is usually an off-the-shelf or commercial type product, but may also include hardware or software already developed by or for the DoD, or other military services or foreign military forces."

Certain key phrases imply that any software developed by the contractor can qualify as NDI. These phrases have been underlined. All three of these standards indicate that any software developed by the contractor without Government funding is NDI. MIL-STD-973 also indicates that some alteration to the NDI software package is permissible. This alteration of the NDI software using Government funds has been the basic cause of many of the differences in opinion between Government and contractor personnel. How much alteration is "some alteration"? Some people feel that as much as 50 percent alteration of NDI is allowable before the software loses its NDI qualification; others feel that no alteration is allowed.

If NDI software is so difficult to define and causes so many problems, why do both Government and contractor personnel insist on using it on Government contracts?

REASONS FOR USING NDI SOFTWARE

There are many advantages for using NDI software. Some of these advantages are primarily from the Government perspective, others are more beneficial to the contractor, while still others benefit both the Government and the contractor. These advantages are offered below for consideration.

Reduced cost. In our current environment of reduced operating budgets, this is probably the single biggest advantage for using NDI software. From the Government's point of view they simply save money on their procurement. NDI software allows the contractor to allocate his development costs over several contracts, commercial as well as Government; therefore, no one contract has to bear the entire cost of the NDI software development. The big advantage to this cost savings from the contractor's point of view is that it gives them a competitive advantage over other bidders. Software development costs are high. In today's world, software costs, particularly on one-of-a-kind systems, are often much higher than any other cost on the project. If the contractor has unique NDI software sitting on the shelf which can be used to solve the customer's problem, the contractor can sell that product to the customer at a price that is substantially less than the development cost of the product.

Reduced schedule. Software is often the real schedule driver on a new development project. If a substantial amount of the software for the contract can be obtained as NDI, the product

development time can be significantly decreased. The advantage of this reduced schedule from the Government's perspective is obvious. The Government often needs to have systems fielded much sooner than is possible because of the development time required for new, one-of-a-kind products. If NDI software allows a contractor to field a system sooner than otherwise possible, the Government would generally be quite pleased. Because the majority of contractors are in business for the purpose of making a profit, the advantage to them is that their costs are further reduced as the schedule is reduced. There are certain overhead costs that are linearly tied to schedule duration; thus, if the contractor can reduce schedule, he can reduce cost.

High reliability. The Government has the right to have certain expectations concerning NDI software. They have the right to assume that the software has been properly developed, has been properly tested, and is ready to be delivered or modified (if modification is required). If the NDI software meets these expectations, the Government has the right to expect that the software works properly and has been even more thoroughly tested than what they would expect on a newly developed software package. One would expect to find few or no problems with the NDI software package during testing or after it is fielded.

Reduced life cycle costs. The costs of maintaining and supporting NDI software should be much less than those for newly developed, unique software. The product should be mature, which will reduce the cost of finding and correcting errors. The product should also be isolated enough from the unique software such that it does not need to change when the unique software changes.

Encourages companies to invest. Another advantage of NDI software is that it encourages contractors to invest their own money in developing "off-the-shelf" software packages. As mentioned earlier, the contractor does this to gain the competitive advantage that he seeks.

Improved efficiency. NDI software is developed to the contractor's standards. The software can be made more efficient with respect to computer resources, (i.e., CPU time, memory, and disk space). The programming language that best fits the need can also be used (e.g., "C", Ada or assembly language).

These are the advantages of using NDI software. Obviously, there must be some problems associated with the subject or there would be no need for this paper. Some of the problems experienced by AAI are presented below.

PROBLEMS IN USING NDI SOFTWARE

Though there are many advantages to using NDI software, there are also some problems associated with its use. These problems vary in severity depending on the observer's perspective. Some of the problems presented below are purely from the Government's point of view while others are from the contractor's point of view.

Qualification of NDI software. This is typically a major problem from the contractor's point of view. Imagine that you were just awarded a contract where you assumed that 80 percent of the software on the contract would be classified as NDI software. Further assume that as the contract progresses, you will need to modify the NDI software by approximately 20 percent.

You now have the makings of a real NDI problem. Your customer is most likely not going to want to qualify your software as NDI because you are using Government money to significantly change your company-owned NDI software. There is a

good chance that five things are going to happen to you now.

1. Your customer is going to want to review the entire software package which means that you must have design reviews with the customer for this so called NDI software.

2. Your customer is going to want a complete set of software documentation for the software package to whatever standard is required by the contract.

3. Your customer will test the complete software package just as if it were a new development.

4. Your customer is going to want the rights to the software because he has paid for its modification. This means that the customer can give the software to other contractors if it is required for them to modify your software at some future date.

5. You are probably going to lose money on at least this portion of the contract.

Documentation may be poor. One problem faced by the Government with NDI software is that the software is developed and documented to the contractor's standard. Depending on the contractor, this standard can be acceptable or unacceptable. The contractor, however, certainly expects the Government to accept the documentation in whatever format and to whatever degree they have provided.

Development standards. Government personnel often feel uneasy in accepting NDI software that was developed to a standard that is invisible to them. The contractor's position is that if the software works, it does not matter how it was developed. The Government has repeatedly demonstrated that they are uncomfortable with this attitude.

Testing. The contractor generally feels that if a software package is NDI software, it should be exempt from some of the rigorous testing that would be performed if the software were uniquely developed for a particular contract. After all, how many people do a thorough test of a compiler or a word processor package before they accept (buy) it? The Government's attitude is usually that the contractor is not MICROSOFT, that the software is not as mature as the items listed in the examples, and that they, the Government, want to test the software before they accept it. Again, this has led to more than one interesting discussion.

Data rights. Remember our poor program manager with the NDI software package. After, the Government has decided that the modified NDI is no longer NDI, they want complete rights to the software. After all, they are funding a significant portion of its development.

What we need in the industry is a more rigorous definition of what is required for a software package to be considered NDI.

NEED FOR A BETTER DEFINITION/UNDERSTANDING OF NDI

All of the advantages discussed above are reasons enough to justify the use of NDI software on Government contracts; however, the problems show that there are some issues that need to be resolved.

We need a better definition of what constitutes NDI software. In the minds of some people, NDI software means that the offeror has a completed software package that has a clear interface to other hardware and software components and that will not require any modification during the life of the subject contract. To others, at the opposite extreme, NDI software is any software package that they (i.e., the contractor) developed to be

interfaced with other non-NDI in any way required. What most people consider as NDI software falls in between these two extremes.

Based on the Government's own definitions given at the beginning of this paper, either of the software packages in the above example can qualify as NDI. After winning a contract, however, the program manager may find that it is quite difficult to get a software package qualified as NDI.

The rules for NDI software need to be explicitly defined. Does the software have to be unmodified to be considered as NDI? If it can be modified, to what extent can it be modified before it loses its NDI status? If the NDI software is modified, does it lose any of its NDI advantages? This issue is not for us to decide and is not really the subject of this paper; however, the following must be considered. There is a balance between allowing only mature, stand-alone software packages to qualify as NDI and allowing any previously developed contractor software to qualify as NDI. As the requirements for NDI qualification become tougher, the Government may receive less NDI on its contracts and will, therefore, eliminate some opportunities for cost savings. If, however, the Government accepts virtually anything as NDI, they will receive a lot of software that is not properly developed, documented, and tested. This will result in the Government receiving substandard products.

It is extremely important from the contractor's point of view that the proposal team know the rules for NDI software. It is not fair for a proposal team to bid one price for a development effort based on their assumption as to what will be NDI and what will be developed, then find out after contract award that their assumptions are not acceptable to the Government project team.

SPECIFIC EXPERIENCE ON THE DRLMs PROGRAM

AAI has had some very recent experience with the trials and tribulations of NDI software. AAI has been under contract with the USAF to build a software intensive Digital Radar Landmass Simulator (DRLMS). It was known by both the government and AAI at the onset of this contract, that most of the software which AAI would be using on this program had been developed by AAI using IR&D funds. This software has become known as the "core" DRLMS software because it performs the basic radar functions required by any software intensive DRLMS.

Early in the program, AAI and the government established that a significant portion of the "core" DRLMS software would be used on the program and that this software would be categorized as NDI. Other software developed on the program would be trainer unique and the Government would retain ownership of this software and its documentation. Also, these other, non-NDI, items would be documented in accordance with the contract requirements, which meant a Software Design Document (SDD), and a Software Product Specification (SPS) would be developed by AAI.

In order to establish some sense of continuity in the SDD, AAI agreed to provide a high level description of the NDI software in the SDD, while providing a fully specification compliant SDD for the unique software. In the SPS, listings would be provided only for the trainer unique software.

As the program progressed, AAI found the need to make modifications to the established NDI software. The question was immediately asked: "Is this code still NDI?". There was no simple answer to the question. There were no established guidelines as to what degree of modification transforms NDI software into trainer

unique software. Herein lies one of the basic problems with using NDI software.

AAI maintained that, while in some cases the software was being significantly changed, the basic algorithms remained unchanged; and therefore, the modified software still qualified as NDI. This disagreement persisted throughout most of the program, even up until the physical configuration audit (PCA). Fortunately, for AAI, an agreement was reached with the Government and the issue was eventually settled.

Had the Government representatives been less reasonable or less willing to work with the AAI team , AAI could have incurred a significant schedule delay with an associated cost overrun.

PROBLEMS AND RECOMMENDATIONS

In spite of the problems encountered using NDI software, the concept is certain to stay. The issue of what is NDI software and what does it mean to be NDI software may not be resolved for a long time. There are some lessons which have been learned by the Government and industry. Some of the problems encountered and a recommendation of how to prevent them is presented below.

PROBLEM. Using nondevelopmental item software may seem like a panacea. But, there are many pitfalls that can make the experience extremely unpleasant.

RECOMMENDATION. The Government and contractor personnel need to work together early in the procurement cycle to reach an understanding concerning NDI software. The contractor needs to make their intention known, and the Government needs to let the contractor know its position on the contractor's intent.

PROBLEM. Often the Government and the contractor do not agree as to what qualifies as NDI software.

RECOMMENDATION. If the contractor intends to use NDI software on the contract, let the Government project team know as soon as possible (i.e., during the proposal phase). Come to an agreement as to the acceptability of the software as NDI before preparing the final cost estimate.

PROBLEM. The alteration of NDI software using Government funds has been the root of many differences in opinion between Government and contractor personnel as to whether the software package is still NDI.

RECOMMENDATION. This is probably the most serious problem you will face. Be sure to let the Government know up front if you intend to modify your NDI software to meet the contractual requirements. Reach an agreement that both parties can live with before contract award.

PROBLEM. If a software package qualifies as NDI, the Government may still expect certain considerations pertinent to the software package. They may require documentation and design reviews of the software package. The Government may also want to acquire certain rights to your software package even though it qualifies as NDI.

RECOMMENDATIONS. Communicate with your customer. Make sure that you and the customer are in agreement as to what design reviews , if any, will be held, what documentation will be provided and what rights are being given to the Government. Make sure you reach an agreement before contract award.

PROBLEM. The existing definitions of NDI software leave too much latitude. Government and contractor project personnel can both be

talking about NDI software, thinking that they are talking about the same thing when, in fact, they are not.

RECOMMENDATION. We need a better definition of what constitutes NDI software. The *definition needs to address NDI software* qualification, documentation, and testing standards. The definition needs to address modification of NDI software using Government contract funds and to define who owns the NDI software and what it means to own the software.