R-TOC Bridge Project: Comparison of the Implied Work Breakdown Structure and the IDA Work Breakdown Structure

A key component to the IV&V is the verification and validation of the work breakdown structure (WBS) used in the IDA CBA (Levine et al. 2010). The IDA WBS was used to generate the functional units of the CBA: 1) the estimated personnel hours to produce a nominal 500-page technical manual under current processes ("As-Is") versus the anticipated processes using the Bridge ("To-Be") and 2) the estimated number of personnel hours to produce a nominal one-content-hour training course under current processes ("As-Is") versus the anticipated processes using the Bridge ("To-Be").

As defined in the Statement of Work contained within the Purchase Order dated January 10, 2011, Task 2 entailed two subtasks. First, an "implied work breakdown structure" (IWBS) was to be derived for the Course Development/Revision Process followed by the Navy. The concept of an "implied" WBS is used within this project and document to indicate that the WBS is extracted or derived from relevant Navy Guidance Manuals and documents. The second Subtask, the IWBS, the product of those efforts would be compared and contrasted with the IDA WBS for the purpose of verifying and validating the IDA WBS. The verification has as its goal to verify the degree to which the specific WBS elements (80 in the case of the IDA WBS for producing training content) correspond to those in the IWBS.

There some key considerations affecting this effort. First, the verification would have entailed discussion with individuals who contributed to the IDA WBS verifying their representation of the WBS for training content production with the IWBS. The validation would normally have been conducted with the assistance of experts in training content production, e.g., personnel at Navy sites or contractors engaged in such activities that are *different* from those who contributed to the initial analysis; this would be the external element which is demanded by validation. Second and most importantly, the guidance for producing Navy Training Content is <u>in flux</u> at this time. As part of this dynamic environment, key vendors are working with the Navy to automate production of training content according to NETC specification and to include the Bridge. As will be discussed in the next section, the key guidance manual for developing or revising courses has been heavily revised, exists in draft form and is awaiting further comment, finalization and approval. The sudden curtailed of the project precluded intermediate interaction with such experts, but such interaction regarding the comparison should be considered for future work as indicated in the recommendations section. This is especially desirable to do after the Navy guidance stabilizes and is approved by the necessary authorities.

Derivation of the Implied Work Breakdown Structure

Initial discussions with other personnel on the R-TOC Bridge project pointed to a particular document, NAVEDTRA 136, the ILE Course Development and Life-cycle Manual, as the correct focus for this portion of the R-TOC subtask. Another recommendation was made to examine the Navy Education and Training Command's (NETC) recently published high-level graphic of the Course Development and Revision Process Map. This graphic associates ten authoritative Navy documents with each of seven main phases of the process, which

contain guidance and more detailed information for carrying out the processes. These ten documents, in turn reference additional documents. The graphic serves as the foundation for the more detailed work breakdown structure derived in this task (NETCINSTR-1500.9, 2010). The portion of the diagram relevant to the study at hand is represented in Figure 1 below.

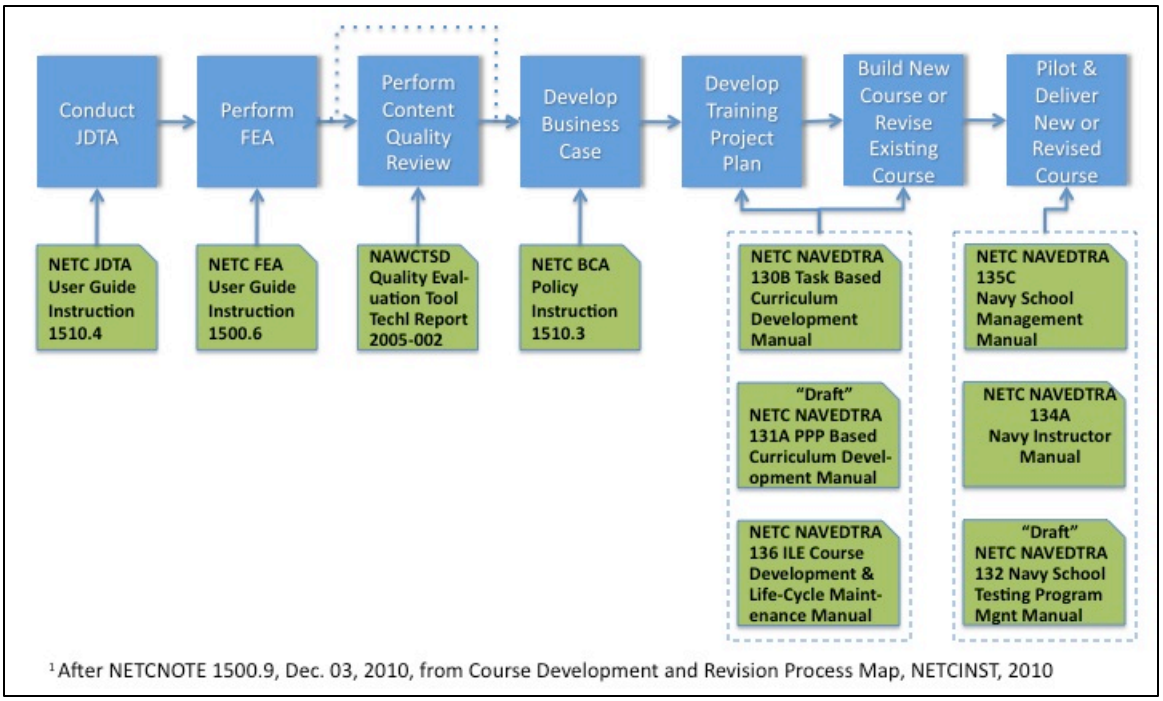

Figure 1. Course Development/Revision : End-to-End Process

Unlike the original graphic, Figure 1 does not include the trigger event received by an external or internal requirement source that initiates the course development of revision process that was in the original graphic. Trigger events range from change in the Navy Mission Essential Task List to requirements sponsor changes, but they are outside the course development/revision process and so is not included in the IWBS. The process depicted in Figure 1 represents a standardized way to respond to such triggers and evaluate whether and how to develop or change content.

Both according to NETC's depiction of course development and revision in Figure 1 as well as personnel working on the R-TOC Bridge project, the NAVEDTRA 136 guidance manual was expected to serve as the sole authoritative source for defining the ILE course development and life-cycle maintenance WBS. According to the NAVEDTRA 136 manual, the "NETC Integrated Learning Environment Course Development and Life-Cycle Maintenance Manual provides direction for developing and maintaining instructor-led training, interactive multimedia instruction, and blended training materials for delivery using current technologies and best practices to enhance institutional and individual learning and performance support for the Navy's Total Force at home, schoolhouse, or afloat" (NAVEDTRA-136, 2010, pg iii). As such, using NAVEDTRA 136 one should be able to derive the ILT WBS.

NAVEDTRA 136 defines seven phases or subprocesses comprising the *Build New Course or Revise Existing Course* process from Figure 1: Planning; Analysis; Design: Development; Implementation; Evaluation and Life-cycle Maintenance (mnemonically referred to as PADDIE+M). However, analysis of NAVEDTRA 136 indicates that the first five (5) phases depicted in Figure 1's NETC Course Development/Revision : End-to-End Process (*Conduct JDTA*, *Perform a Front-End Analysis*, *Perform Content Quality Review*, *Develop Business Case* and *Develop the Training Project Plan)* are actually all part of the Planning subprocess of the *Build New or Revise Existing Course process* rather than as being independent of and feeding into it. This interpretation is consistent with each of these processes as producing Planning Phase outputs (see NAVEDTRA 136 Table 1, pg. 2-9). Finally this is consistent with the fact that the IDA WBS clearly includes as one of its earliest (2nd) task, *Conduct JDTA (Job, Duty, Task Analysis)*. Figure 2 depicts the representation of the process flow if one follows NAVEDTRA 136.

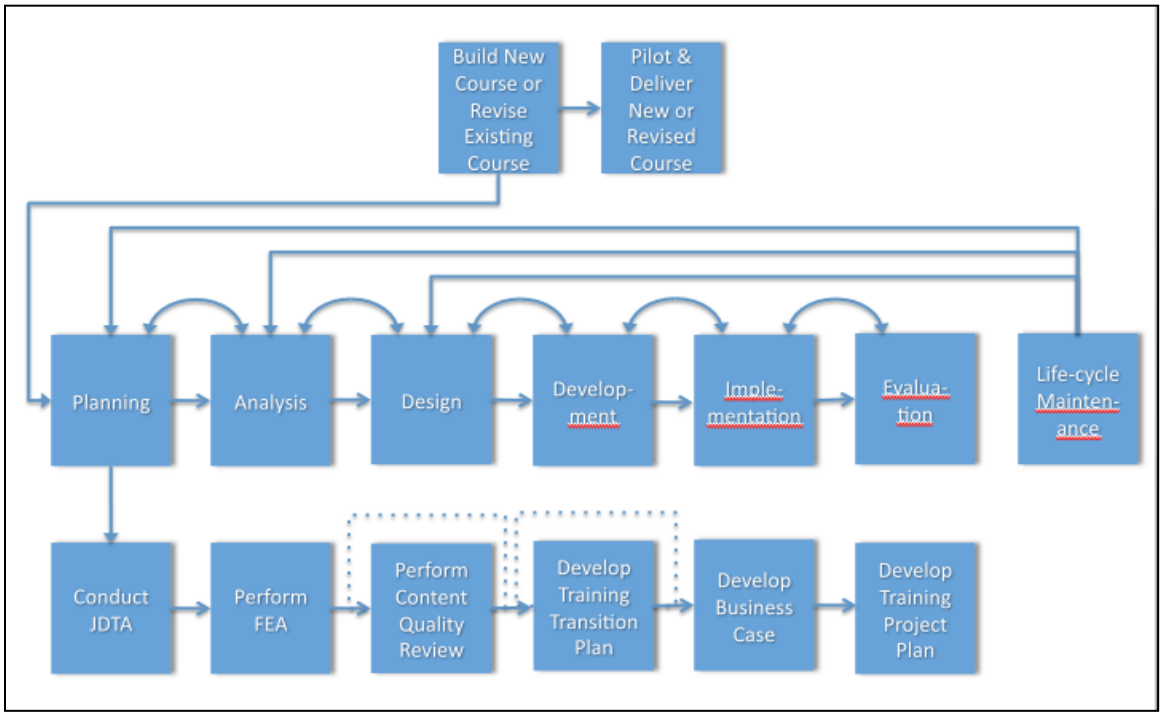

Figure 2. Graphic Combination of NETCNOTE 1500.9 (Figure 1) and the NAVEDTRA 136's Definition of the Planning Phase

The ramifications of this inconsistency are twofold. First, eight Navy guidance documents had to be consulted rather than one (NAVEDTRA 136) to conduct this R-TOC Subtask and derive the IWBS. NAVEDTRA 130 and 131 series did not really figure into the analyses since they focus content rather than process. The time required to review this several-fold increase in documentation was weighed against goals to accurately capture the IWBS. There may thus be WBS elements that were omitted. Further examination of these manuals may be warranted in future work.

Second, although the accurate representation differs from that as NETC's high level representation in Figure 1, the lowest level elements that are subject to cost estimation, called leaf nodes in the WBS, will remain the same (assuming consistency in the multiple task definitions across the many manuals), and not affect their usage in the cost analysis that might be conducted.

Another inconsistency between NETC's rendition of course development and revision and NAVEDTRA 136 is that the latter included an additional process entitled here, *Development Training Transition Plan*. According to NAVEDTRA 136 and OPNAVINST 1500.76, this process should be carried out between the *Front End Analysis* and the process *Develop Business Case*. Based on its definition, the process *Develop Training Transition Plan* has been inserted before the process *Perform Quality Evaluation Review*.

Finally, another source of information was found: the Navy Training Development Plan Process Flow (Scribd, 2010). Unfortunately, this resource was delivered as a single diagram with no reference to source using SCRIBD, an on-line viewer. The process flow given, though, was likely interpreted from the Navy ILE Content Developer's Handbook (MPT&ECIOSWIT-ILE-HDBK-1C, 2009). There are useful practical steps included in this process flow that would be necessary to take during actual development and implementation of training content. NAVEDTRA 136 did not cite many of these practical steps.

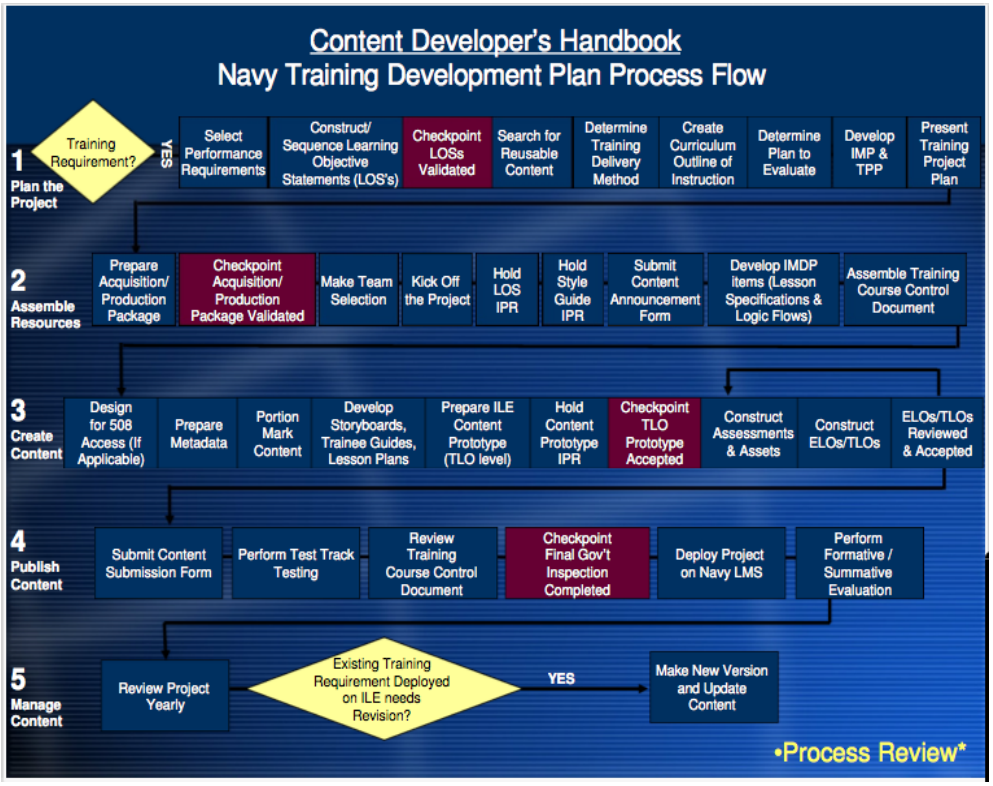

Figure 3. Navy Training Development Plan Process Flow

The Implied Work Breakdown Structure

The IWBS was initially constructed and documented as the guidance manuals were read using a free demonstration version of WBS Chart Pro Demo 4.8[1]. The analog Task List is generated simultaneously in MS Project as the WBS was created as a supposedly seamless feature between the two. In reality, any information inserted into the WBS Chart Pro text fields is lost in the "integration". Similarly the notes field information in MS Project is not carried back to WBS Chart Pro. To adjust for this lack of functionality, the notes from the WBS were manually copied to the "Notes" field associated with each task in the MS Project task list. This was fortuitous due to further limitations to the WBS Chart Pro demo version. The demo version is limited to 50 tasks, which when reached prevents users from adding tasks and also denies access to the task definition object. For this reason, the remainder of the WBS was codified in the MS Project task list exclusively. Beyond the 50 tasks, definitional information and references from the authoritative sources for each task were inserted into the notes section of each task in MS Project as consistently as possible. Figure 4 shows how WBS Chart Pro represents Levels 0-1, with one task, *Build New Course or Revise Existing Course,* expanded to Level 2. The ability to collapse and expand at various levels facilitates construction of the WBS.

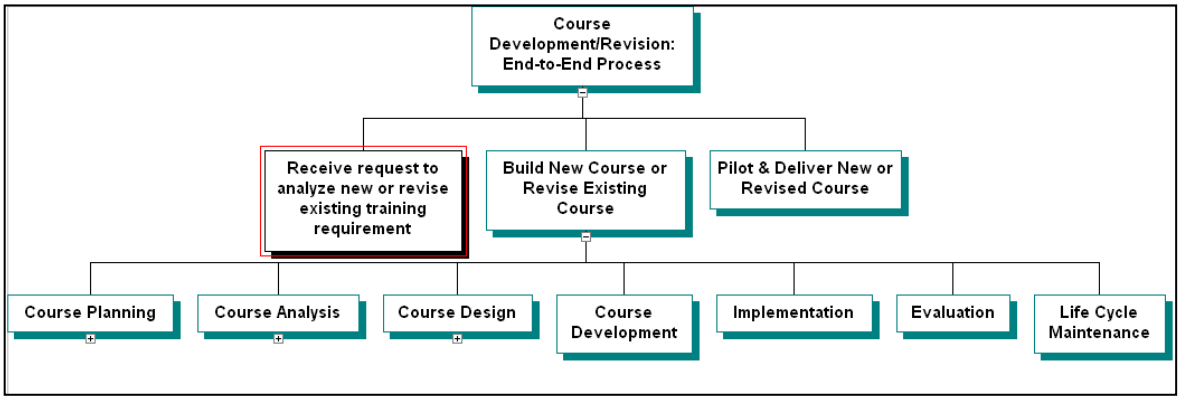

Figure 4. Level 2 Depiction of the Course Development/Revision WBS

Some Navy guidance documents referenced in NAVEDTRE 136 could not be located. For example, the document providing guidance for the Business Case Analysis phase, CNETINST 1510.3, entitled *Standard Training Activity Support System (STASS)*, dated 5 January 1999. Also, the document mentioned above, the ILE Content Developer's Handbook (MPT&ECIOSWIT-ILE-HDBK-1C, 2009), is stated to be "consistent with, and based on, the more detailed ILE content guidance provided at www.netc.navy.mil/ile." However the URL given is not accessible. Despite these obstacles, an IWBS was constructed that encompassed the end-to-end processes defined to construct new or revise existing training courses.

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[1] WBS Chart Pro is a Windows-based project management software application for creating and displaying projects using a Work Breakdown Structure (WBS) chart. A WBS chart can collapse to any level and is seamlessly integrated with MS Project.

In anticipation of the reader not having access to either or MS Project, the tasks were saved as an html webpage, which would preserve the hierarchical structure of the WBS. An attempt was made to output the IWBS element notes, however the field sizes could not be controlled and they were truncated. Figure 5 provides a screen capture of a portion of the MS Task List for the IWBS. The Summary Task Information window, which holds referential and definitional information is also given.

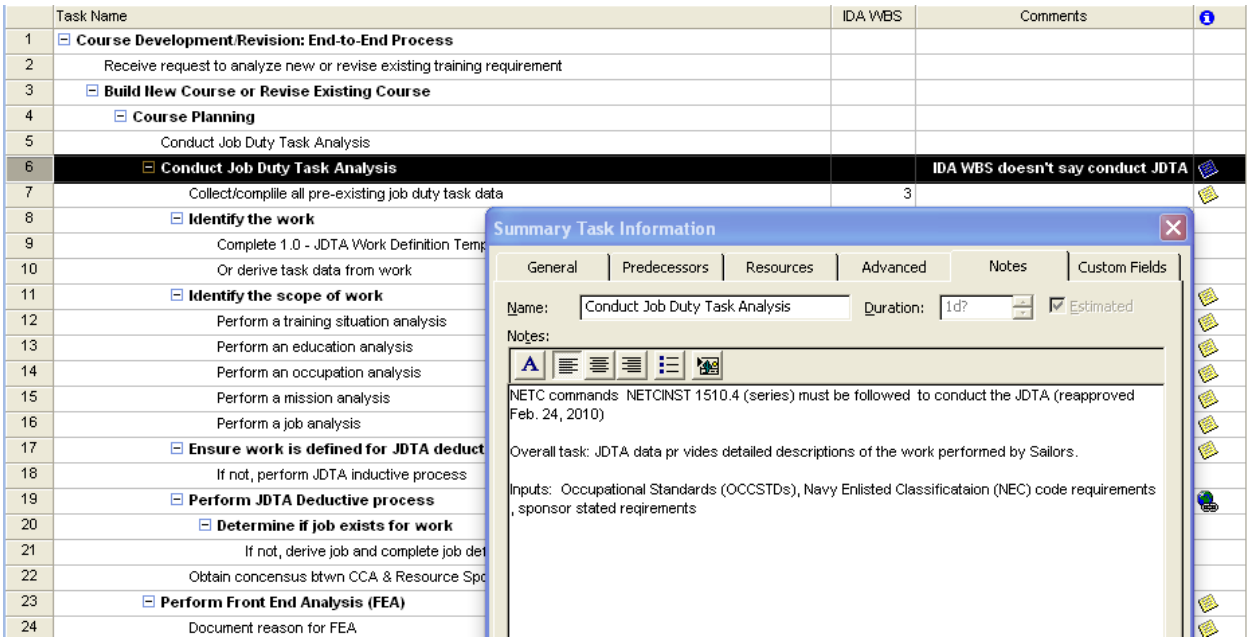

Figure 5. The IWBS stored in MS Word with Opened Summary Task Information Window

Comparison of the Implied and IDA Work Breakdown Structures

The goal of the comparison between the implied and IDA work breakdown structures (IWBS and IDA WBS) was many-fold:

- The IWBS to IDA WBS comparison might address whether the IDA CBA, which focused on the production of CBT curricular material, would be valid for Instructor-led Training (ILT) curricular material production.
- The comparison could lend insight into whether the IDA WBS, and presumably the system from which it was derived, was aligned with authoritative sources. This would potentially enable more effort at an IDA WBS site visits to be focused on estimating the costs (personnel hours) needed to perform the processes.
- A potential outcome of the comparison would be obtaining a data point on the adherence of training content developers to the Navy guidance documents in practice.

Comparison with the IDA WBS was somewhat hampered by the fact that IDA WBS tasks were given as a list without any definition, reference, or indentation, which would have indicated a work breakdown hierarchy. No graphical work breakdown structure was provided either. The abridged titles were all that were available to interpret the tasks.

After some effort comparing the IWBS and the IDA WBS, it appeared as though the Navy document, the *ILE Content Developer's Handbook,* significantly contributed to the IDA WBS. This was not substantiated. *ILE Content Developer's Handbook*, as it were, subsequently served a source for the IWBS, precisely because it offered some practical activities/steps in the production process.

It was inferred that some tasks without cost information (staff-hours) were not leaf nodes, but rather aggregate nodes, i.e., work breakdown structure elements composed of multiple leaf nodes. Conversely, other tasks with no associated cost information appeared to be associated with the "To Be" case of the Bridge. For example, Task ID 16 is described as *Access CSDB via the API to search for reusable DMs*. The Common Source Database and Data Modules are components in S1000D. Thus the task lists for the "as is" and "to be" cases were commingled without identification. The column titled *Comments* in the IDA WBS captures tentative conclusions about whether a task is aggregate tasks expect Bridge tasks.

Difficulties such as these would normally have been resolved through discussion with subject matter experts (SMEs) involved in the processes associated with producing curricular content, either those who generated the IDA WBS or those whom would have visited as part of the R-TOC Bridge project.

The comparison was thus accomplished based on the similarity of WBS and IDA WBS titles. Titles from the IWBS could be traced and defined back to the other citation location. Attempts were made to understand the titles from the IDA WBS based on the ILE Cotent Developer's Handbook. Then attempts were made to reconcile the two. Figure 5 offers simultaneously a flavor of some difficulties encountered when relying solely on authoritative sources with no input from SMEs and how the comparison was documented. IDA WBS Task ID, given as "3" in the second column titled IDA WBS, entails "Specify training content requirements (through Job Duty Task Analysis and other resources)." The opened Summary Task Information Window and the many subsequent subtask extracted from NAVEDTRA 136 leave room for two possibilities: using existing JDTA data or conducting a new JDTA for a new course. The IDA WBS assigns only 1 staff-hour to this task. Such disparities should be resolved with SMEs.

The IDA WBS and the IWBS were cross-referenced. When WBS Task titles were deemed to match, the IDA WBS Task ID number was inserted into column 3 titled IDA WBS in the MS Project IWBS (filename IWBS.mpp). Similarly the IWBS Task ID number was inserted into Column "P" of the Excel IDA WBS (filename IDA_WBS.xlsx). Comments could also be inserted in the IDA WBS in column "Q". Figure 6 offers a partial screen capture of this mapped file.

Forty-two out of the 80 tasks given in the IDA WBS corresponded to tasks in the IWBS. Fifty-seven out of the 108 tasks given in the IWBS corresponded to task in the IDA WBS. However, these were not necessarily one-to-one correspondences. Additionally, these included non-leaf nodes.

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
	Training Course Staff-Hours: Current Processes															
		Government						Government or Contractor								
Task ID	Task	Training Director	Rate Lead (SME)	Learning Standards Officer	Content Sponsor	Course Supervisor	Contracting Officer	Instructional Systems Designer	Graphics	Animation	Programmer	Editor	Lead	Total	IWBS	Comments
1	Identify training requirements													0		Aggregate WBS element?
2	Identify training product and training environment; review OEM descriptions of systems and equipment		2											2		
3	Specify training content requirements (through Job Duty Task Analysis and other resources)		1											1	5	Does't specify if JDTA data exists or must initiate new JDTA. May correspond to high-level task w/many leaf WBS elements
4	Initiate Navy Enlisted Classification request (if required)		1											1		Per NAVEDTRA 136, NEC request is only one OPNAV training reqt source, which exists outside of training content production process. If NEC is part of process, then must include OCCSTD revision and rate merger

Figure 6. IDA WBS with Staff-hours Cross-Referenced with the IWBS Task (column p)

While this exercise should be executed again with SMEs involvement, a few meaningful observations can be made. First, the IDA WBS is missing many potentially substantive tasks. Since the IDA WBS appears to based largely on the ILE Content Developer's Handbook, this might reflect an emphasis on practical tasks, such as meetings. It might reflect assumptions about the lack of applicability about related subtasks, especially since multi-part tasks are seen to require so little staff-time. Alternatively, some tasks might have accidentally been omitted from the Handbook or some tasks may have been purposefully omitted since they would not likely change if the Bridge were implemented.

Documenting a complete process map (WBS) could offers greater opportunity to accurately estimating the effect of deploying a new integrative technology such as the Bridge. Also, the higher fidelity of a complete WBS promises discovery enhanced efficiencies.

Through this exercise, several omissions are exposed that should be reconciled. Although the IDA WBS seems to conform well with the ILE Content Developer's Handbook, the Handbook seems to omit many, probably staff-hour demanding tasks. First, there is no room for conducting a full scale JDTA. Next, it appears that a complete/formal Front End Analysis is not conducted. The Business Case Analysis is not mentioned. Metadata construction is not mentioned. The IDA WBS and the ILE Content Developer's Handbook

process flow is difficult to follow since random leaf nodes seem are emphasized, out of context and in sequences that are inconsistent with that put forth in the NAVEDTRA 136 document. The NAVEDTRA 136 manual omits ancillary mechanism for accomplishing the tasks such a meetings. The possible omission of a reduction of cost that would otherwise be noticed if the process with which it was associated had been included in the analysis.

Potential Conclusions and Recommendations

This analysis leads to some potentially useful conclusions and recommendations.

SMEs should be made aware of the deviations between the IWBS and the IDA WBS. These deviations should be examined, reconciled, or justified and documented.

The IDA WBS should be documented, citing authoritative sources where possible. From a completeness and organizational perspective, the IDA WBS should be expanded to upper levels of WBS to map the processes and the NAVEDTRA guidance more transparently.

Neither the IWBS nor the IDA WBS suggests that there are any significant differences between producing CBT or ILT curricula content, at not that might be impacted through the implementation of the Bridge. The latter conclusion derives from the fact that the Navy's approach to producing curricular contact is reflected in the NAVEDTRA and other manuals: the generalized processes will address *Integrated Learning Environments.* The expectation is, according to NAVEDTRA 136, that curricular training material will be produced according to the same production process regardless of whether it is destined for a School House, CBT, ILT, or distributed ILT. Content developer's should investigate this claim.

If no (statistically) significant differences exist between producing technical training material with multiple delivery modes, then the R-TOC Bridge project can proceed with conducting cost benefit analyses (CBA) based on a far less restricted subset of site visits. A broader sample of site visits will better capture uncertainties endemic to real-world CBA and thus yield more robust cost benefit estimates.

References

Levine, D., Horowitz, S., Gafford, W., & Fletcher, D. (2010). *The "Bridge" Project Cost-Benefit Analysis 1: Reducing Total Ownership Costs and Increasing Fleet Readiness by Integrating Learning Content and Technical Information Development Processes (Draft)*. Alexandria, VA: Institute for Defense Analyses.

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NETCINSTR-1500.9 (2010). *Training Requirement Identification and Resource Sponsor Commitment*.

Scribd (2010). Navy-Training-Development-Plan-Process-Flow, accessed 2/13/2011, Scribd Inc., http://www.scribd.com/doc/22279178/Navy-Training-Development-Plan-Process-Flow.