

A Comprehensive Approach for Lifelong Learning

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Abstract: Key Points

- **The Air Force Air Mobility Command (AMC) Enterprise Learning Office (ELO) mission is to transform AMC into a premier Air Force learning organization**, achieve learning through optimum approaches and develop Mobility Airmen into life-long learners and well -cultivated critical thinkers who demonstrate institutional Air Force competencies with a positive approach to managing their own learning. In this context, **learning has three main components: training, education, and experience**. The re-engineering of learning to develop and deploy optimum approaches focuses on all components. **AMC ELO is initially focusing on training.**
- **Training is generally represented as only one line within a cost estimate.**
- **This paper presents a training CES**, conveys its value in the broader context of transforming learning, and outlines an approach for using the CES in the context of a BCA. Finally, **preliminary results of the BCA** are presented and interpreted.

Agenda

- Background
- Implications for the BCA
- Cost Element Structure (CES), Benefits Estimating Structure (BES), and Data Collection Instrument (DCI)
- Business Case Analysis (BCA) Implementation
- Preliminary Results
- Conclusion

Background: AMC ELO

- The Air Force Air Mobility Command (AMC) provides global air mobility to our Armed Forces
- The command also plays a crucial role in providing humanitarian support at home and around the world. AMC Airmen—active duty, Air National Guard, Air Force Reserve and Civil Reserve Air Fleet - provide airlift and aerial refueling for all of the United States' armed forces. Many special duty and operational support aircraft and stateside aeromedical evacuation missions are also assigned to AMC
- The mission of the AMC Enterprise Learning Office (ELO) is , in part, *to transform AMC into a premier Air Force learning organization*. Key components include:
 - Achieve learning through optimum approaches
 - Develop critical thinking skills
 - Develop Mobility Airmen into lifelong learners
 - Promulgate and socialize positive approach to Mobility Airmen managing their own learning

Background: Selected Key Terms

- **Agile Learning Design**: An approach to content development that focuses on speed, flexibility and collaboration. The term evolved from the software development industry, in which electronic content development (e.g., e-learning) has similar characteristics to software development.
- **Andragogy**: The methods , techniques , or teaching strategies used (specifically) for *adult* learners.
- **Blended Learning**: A formal education program in which a student learns, at least in part, through online delivery of content and instruction with some element of student control over time, place, path or pace.
- **“Flip the Classroom:”** A form of blended learning in which students learn new content online by watching video lectures, usually at home, and what used to be homework (assigned problems) is now done in class with teachers offering more personalized guidance and interaction with students, instead of lecturing. This is also known as backwards classroom, flipped classroom, reverse teaching
- **Virtual Learning Environment (VLE)**: A web-based education system based that models conventional in-person education by providing equivalent virtual access to classes, class content, tests, homework, grades, assessments, and other external resources such as academic or museum website links. It is also a social space where students and teacher can interact through threaded discussions or chat.

Background:

Business Case Analysis (BCA)

- One of the key tasks associated with transformation of learning at AMC is a Business Case Analysis (BCA)
- A BCA is a comparative analysis among competing alternatives
 - Not to be confused with a budgetary estimate
 - Defines a Status Quo (SQ), As-Is, or Baseline Alternative (Alternative 1)
 - Defines one to three non-SQ To-Be Alternative(s)
 - Wherever possible, monetizes costs and benefits associated with each alternative, *including* implicit costs, imputed costs, and (some) externalities
 - Sunk costs excluded
 - Wash costs may be included or excluded at analyst discretion
 - Each alternative subject to identical overarching ground rules and assumptions and period of analysis
- Each alternative is estimated using a common Cost Element Structure (CES) and Benefits Estimating Structure (BES)

Background:

AMC BCA

The BCA for AMC ELO considers two alternatives:

- Baseline Alternative: Reflects the state of the world in which AMC training proceeds as it would have without any of the contemplated elements of transformation
- To-Be Alternative: Reflects the state of the world in which AMC training is transformed using a variety of optimum approaches to learning. For the purpose of the BCA, the transformation includes several key elements:
 1. Implementation of Agile Instructional System Design (ISD), an approach to training content development that focuses on speed, flexibility, and collaboration
 2. Modification of the virtual vs. classroom mix of courses using blended learning environment
 3. Implement best practices related to andragogy, including *Flip the Classroom*
 4. Make maximum feasible use of VLEs

Implications for the BCA

- We need a CES to organize costs
- We need a BES to organize benefits
- We need to quantify the costs and benefits of the Baseline and To-Be Alternatives, and monetize that value wherever possible
- Approaches must be in line with industry best practices, well-documented, traceable, and repeatable
- Ideally, we would like to set the standard for how training cost estimates and comparative analyses are to be done

Cost Element Structure (CES)

Follows many best practices of, but not to be confused with, a Work Breakdown Structure (WBS)

Attribute	CES	WBS ¹
Elements are...	Cost Elements	Work Packages
Follows general outlining principles, Follows 100% rule	✓	✓
Mutually Exclusive	✓	✓
No Orphans	✓	✓
No Single Children	✓	✓
May Contain Activities	✓	✗
Highest Level Is...	At least two phases	One Deliverable

1. Based on WBS best practices found in the Project Management Body of Knowledge (PMBok) Guide, 5th edition.

WBS vs. CES:

Which One for Cost Estimating?

- **It is a best practice to use a CES** to breakdown elements of *cost*, just as it is a best practice to use a WBS to breakdown elements of *work*
- In the Project Management Body of Knowledge (PMBok) Guide, all costs are estimated at the Activity Level (rolled up to the work packages they support later)
- PMBoK, The Cost Estimating Body of Knowledge (CEBoK), and the GAO Cost Estimating and Assessment Guide state that WBS's should be **product-oriented**
- But our end item is not a product. It is a service
- We propose that cost estimates should be oriented toward the ultimate aim of the program, regardless of whether it is a product. An *activity-oriented* CES is an appropriate breakdown for the training *service*. It also facilitates *activity-based costing* (ABC).
- The items are beyond the scope of MIL-STD-881C, which contains no appendix for Training, no provisions for the acquisition of defense *non-materiel* items, and no guidance beyond the acquisition phase

WBS/CES Research

- Our literature review yielded very little in the way of standardized, published WBS's and CES's that are specific to training
- Usually just two cost elements (Initial Training, Recurring Training), to train users on a thing. Here, training *is* the thing!
- Some suggestions we received:
 - Heavily customize AIS/ERP Appendix of MIL-STD-881C
 - Heavily customize OSD PA&E AIS EA Guide
 - Heavily customize DHS IT LCC WBS
 - Take a long walk off of a short plank
- We eventually found a specific training Cost Breakdown Structure (CBS) developed by the North Atlantic Treaty Organization (NATO) ¹

NATO Training CBS

- Provided a good starting point for our training CES
- At the highest level, organizes cost elements into three main buckets:
1.0 Investment, 2.0 Operating & Support, & 3.0 Decommissioning
 - Investment & Decommissioning elements contain a useful way to decompose the cost of implementing a new, “to-be” training alternative
 - Operating & Support cost elements provides good ideas on capturing the costs of operating a training program that is already “up and running” (e.g. cost of instructors, training devices, updating courseware, software licenses)
- While we used the Decommissioning portion without modification, we found some limitations with the Investment and Operating & Support structures:
 - Little visibility into hardware vs. software costs
 - Full cost of student time not captured
 - No labor costs for managing training investment and operations
 - No breakout of instructor and student time by type (e.g. Military Active, Civilian, Contractor, etc.)
 - Distinction between training content *delivery* and training content *maintenance* unclear

NATO Training CBS

Investment

- 1 initial investment
- 1.1 acquisition cost training devices
- 1.2 development cost course ware
- 1.3 acquisition cost initial logistics support
 - 1.3.1 costs initial spare parts package
 - 1.3.2 costs initial support equipment
 - 1.3.3 cost of training instructors
 - 1.3.4 costs initial documentation
 - 1.3.5 costs computer equipment
 - 1.3.5.1 computer equipment for training devices
 - 1.3.5.2 cost of software
 - 1.3.5.3 cost of secure network
 - 1.3.6 construction costs
 - 1.3.6.1 cost to build new infrastructure
 - 1.3.6.2 cost to adapt infrastructure
 - 1.3.7 preparation costs
 - 1.3.7.1 costs of test and acceptance
 - 1.3.7.2 project costs
 - 1.3.7.3 costs pack/store/handle & transportation
 - 1.3.8 other investment costs

2 operating and support costs

- 2.1 operating costs
 - 2.1.1 cost of instructors
 - 2.1.2 cost of using training devices
 - 2.1.3 cost of refreshment training instructors
 - 2.1.4 cost of updating courseware
 - 2.1.5 cost of updates operating documentation
 - 2.1.6 operating costs new and adapted infrastructure
 - 2.1.7 cost of consumables (fuel, electricity)
 - 2.1.8 travel expenses students/personnel
 - 2.1.9 accommodation costs students/personnel
- 2.2 support costs
 - 2.2.1 cost of support personnel
 - 2.2.1.1 cost of maintenance personnel
 - 2.2.1.2 cost of technical personnel
 - 2.2.2 cost of refreshment training support personnel
 - 2.2.3 cost use of spare parts
 - 2.2.4 cost use of support equipment
 - 2.2.6.1 cost replacements computers
 - 2.2.6.2 cost software licences
 - 2.2.6.3 cost of subscription courseware
 - 2.2.7 cost of data security
 - 2.2.8 cost of outsourcing technical support
 - 2.2.9 cost of outsourcing maintenance
 - 2.2.10 costs to upgrade training devices

Operating & Support

3 decommissioning costs

- 3.1 cost of decommissioning training devices
- 3.2 cost of decommissioning support elements
- 3.3 cost of decommissioning infrastructure

Decommissioning

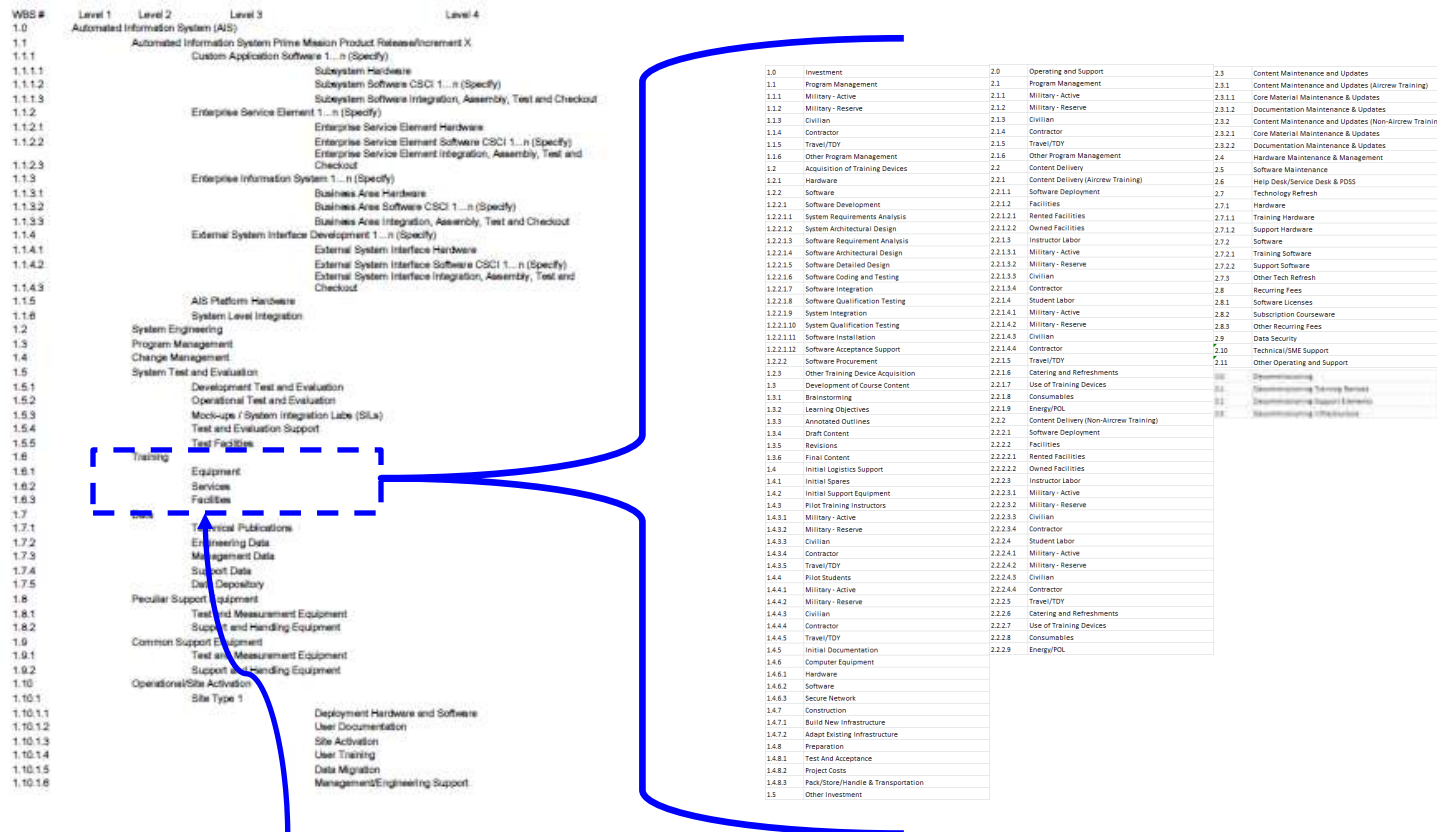
AMC Training CES

Our CES borrows elements from the NATO training CBS but is ***expanded and reorganized*** to facilitate comparison of alternatives and the ability to answer questions posed by leadership

- Added additional elements needed to account for the full cost of training
 - Student labor
 - Program management labor
- Added additional, lower-level elements needed to distinguish among costs requiring different data & cost estimating techniques
 - Active Military vs. Reserve Military vs. Civilian vs. Contractor Personnel
 - Hardware vs. Software
- Re-organized portions of the structure to better reflect the activities that compose training, creating distinctions between:
 - Content delivery vs. content maintenance
 - Aircrew vs. non-aircrew training – an important distinction for AMC as these two types of training use different systems, processes, and buckets of money

AMC Training CES

The result is a comprehensive structure for representing training costs that goes well beyond the normal 2-3 lines for training



Training costs as represented in the MIL-STD-881C WBS for Automated Information Systems

Our new Training CES (140 elements)!

Training CES – 1.0 Investment

1.0	Investment
1.1	Program Management
1.1.1	Military - Active
1.1.2	Military - Reserve
1.1.3	Civilian
1.1.4	Contractor
1.1.5	Travel/TDY
1.1.6	Other Program Management
1.2	Acquisition of Training Devices
1.2.1	Hardware
1.2.2	Software
1.2.2.1	Software Development
1.2.2.1.1	System Requirements Analysis
1.2.2.1.2	System Architectural Design
1.2.2.1.3	Software Requirement Analysis
1.2.2.1.4	Software Architectural Design
1.2.2.1.5	Software Detailed Design
1.2.2.1.6	Software Coding and Testing
1.2.2.1.7	Software Integration
1.2.2.1.8	Software Qualification Testing
1.2.2.1.9	System Integration
1.2.2.1.10	System Qualification Testing
1.2.2.1.11	Software Installation
1.2.2.1.12	Software Acceptance Support
1.2.2.2	Software Procurement
1.2.3	Other Training Device Acquisition
1.3	Development of Course Content
1.3.1	Brainstorming
1.3.2	Learning Objectives
1.3.3	Annotated Outlines
1.3.4	Draft Content
1.3.5	Revisions
1.3.6	Final Content

Adds cost to manage Investment

Breaks out the hardware and software components of training device acquisition

Breaks out content development into lower-level activities

1.4	Initial Logistics Support
1.4.1	Initial Spares
1.4.2	Initial Support Equipment
1.4.3	Pilot Training Instructors
1.4.3.1	Military - Active
1.4.3.2	Military - Reserve
1.4.3.3	Civilian
1.4.3.4	Contractor
1.4.3.5	Travel/TDY
1.4.4	Pilot Students
1.4.4.1	Military - Active
1.4.4.2	Military - Reserve
1.4.4.3	Civilian
1.4.4.4	Contractor
1.4.4.5	Travel/TDY
1.4.5	Initial Documentation
1.4.6	Computer Equipment
1.4.6.1	Hardware
1.4.6.2	Software
1.4.6.3	Secure Network
1.4.7	Construction
1.4.7.1	Build New Infrastructure
1.4.7.2	Adapt Existing Infrastructure
1.4.8	Preparation
1.4.8.1	Test And Acceptance
1.4.8.2	Project Costs
1.4.8.3	Pack/Store/Handle & Transportation
1.5	Other Investment

Breaks out labor costs by type

Includes student labor

Training CES – 2.0 Operating & Support

2.0	Operating and Support
2.1	Program Management
2.1.1	Military - Active
2.1.2	Military - Reserve
2.1.3	Civilian
2.1.4	Contractor
2.1.5	Travel/TDY
2.1.6	Other Program Management
2.2	Content Delivery
2.2.1	Content Delivery (Aircrew Training)
2.2.1.1	Software Deployment
2.2.1.2	Facilities
2.2.1.2.1	Rented Facilities
2.2.1.2.2	Owned Facilities
2.2.1.3	Instructor Labor
2.2.1.3.1	Military - Active
2.2.1.3.2	Military - Reserve
2.2.1.3.3	Civilian
2.2.1.3.4	Contractor
2.2.1.4	Student Labor
2.2.1.4.1	Military - Active
2.2.1.4.2	Military - Reserve
2.2.1.4.3	Civilian
2.2.1.4.4	Contractor
2.2.1.5	Travel/TDY
2.2.1.6	Catering and Refreshments
2.2.1.7	Use of Training Devices
2.2.1.8	Consumables
2.2.1.9	Energy/POL

Adds cost to manage training

Includes student labor

Breaks out labor costs by type

2.2.2	Content Delivery (Non-Aircrew Training)
2.2.2.1	Software Deployment
2.2.2.2	Facilities
2.2.2.2.1	Rented Facilities
2.2.2.2.2	Owned Facilities
2.2.2.3	Instructor Labor
2.2.2.3.1	Military - Active
2.2.2.3.2	Military - Reserve
2.2.2.3.3	Civilian
2.2.2.3.4	Contractor
2.2.2.4	Student Labor
2.2.2.4.1	Military - Active
2.2.2.4.2	Military - Reserve
2.2.2.4.3	Civilian
2.2.2.4.4	Contractor
2.2.2.5	Travel/TDY
2.2.2.6	Catering and Refreshments
2.2.2.7	Use of Training Devices
2.2.2.8	Consumables
2.2.2.9	Energy/POL

2.3	Content Maintenance and Updates
2.3.1	Content Maintenance and Updates (Aircrew Training)
2.3.1.1	Core Material Maintenance & Updates
2.3.1.2	Documentation Maintenance & Updates
2.3.2	Content Maintenance and Updates (Non-Aircrew Training)
2.3.2.1	Core Material Maintenance & Updates
2.3.2.2	Documentation Maintenance & Updates
2.4	Hardware Maintenance & Management
2.5	Software Maintenance
2.6	Help Desk/Service Desk & PDSS
2.7	Technology Refresh
2.7.1	Hardware
2.7.1.1	Training Hardware
2.7.1.2	Support Hardware
2.7.2	Software
2.7.2.1	Training Software
2.7.2.2	Support Software
2.7.3	Other Tech Refresh
2.8	Recurring Fees
2.8.1	Software Licenses
2.8.2	Subscription Courseware
2.8.3	Other Recurring Fees
2.9	Data Security
2.10	Technical/SME Support
2.11	Other Operating and Support

Creates clear organization of maintenance vs. refresh costs for both hardware and software

Creates separate categories for Content Delivery vs. Content Maintenance/Updates (further broken out into Aircrew vs. Non-Aircrew)

Training BES Research

- Similar to the CES research, we found little in the way of standardized, published BES's that are specific to training
- We reviewed the BES provided in the *OSD PA&E AIS EA Guide* ¹, but this structure lacks an intuitive way to organize and categorize *benefits*
 - Top level elements are organized around “*types of money*”/costs - RDT&E, O&M, Procurement, Construction, and Military Personnel ²
 - While this could be useful if all benefits could be expressed in terms of cost savings, not all benefits can be translated to a cost savings within the timeframe of the analysis

1. Wilson, Ronald C. *OSD PA&E AIS EA Guide* (1995).

2. Structure is derived directly from the major cost categories defined in OMB Circular A-11, *Preparation and Submission of Budget Estimates*

Training BES Research

- We decided to base our structure largely on the guidance provided in the Cost Estimating Body of Knowledge (CEBoK) ¹
- Structure organized around three major types of benefits:
 - 1.0 Quantifiable Monetary
 - 2.0 Quantifiable Non-Monetary
 - 3.0 Non-Quantifiable
- **1.0 Quantifiable Monetary** was further decomposed into **1.1 Cost Savings**, **1.2 Cost Avoidance**, and **1.3 Improved Productivity** benefit elements (also based on CEBoK guidance)
- Finally, we based the remaining lower-level elements on the initiatives being pursued in the To-Be Alternative
 - In the case of our BCA, all of our Quantifiable Monetary lower-level elements fell into 1.1 Cost Savings or 1.3 Improved Productivity
 - Developed specific 1.1 and 1.3 lower-level elements based on an analysis of how the two key initiatives of the To-Be Alternative drive both cost savings and productivity improvements (see mapping on next slide)

Training BES Creation

Notional Implementation of "To-Be Alternative"

New Agile ISD Process

Increase % of "Virtual" Courses

1.1 Cost Savings

1.3 Productivity Improvements

1.1.2
Core Material Updates & Maintenance

Less time (labor cost) needed to update content

1.1.1.1.1-1.1.1.1.3
1.1.1.2.1-1.1.1.2.3

Facilities Rental

Travel/TDY

Refreshments

Costs reduced when there are less classroom courses

1.3.1.-1.3.2

More Student Time

More Instructor Time

*Virtual Self-Paced courses – reduced time to complete courses, instructors do not have to be present
All Virtual courses – reduced or no travel time*

1.1.1.1.4, 1.1.1.2.4

Contractor Labor

More "self-paced" courses reduces need to contract instructors

Key

Blue element

= Linked to "Increase % of Virtual Courses"

Red element

= Linked to "New Agile ISD Process"

Complete Training BES

BE #	BE Name
1.0	Quantifiable Monetary
1.1	Cost Savings 1.1 Cost Savings
1.1.1	Cost Savings - Content Delivery
1.1.1.1	Cost Savings - Content Delivery (Aircrew Training)
1.1.1.1.1	Facilities
1.1.1.1.2	Travel/TDY
1.1.1.1.3	Refreshments/Catering
1.1.1.1.4	Contractor Instructor Labor
1.1.1.2	Cost Savings - Content Delivery (Non-Aircrew Training)
1.1.1.2.1	Facilities
1.1.1.2.2	Travel/TDY
1.1.1.2.3	Refreshments/Catering
1.1.1.2.4	Contractor Instructor Labor
1.1.2	Cost Savings - Core Material Updates & Maintenance
1.1.2.1	Core Material Updates & Maintenance - Aircrew Training
1.1.2.2	Core Material Updates & Maintenance - Non-Aircrew Training
1.2	Cost Avoidance

1.3	Improved Productivity
1.3.1	Value-Added Time Away from Aircrew Training
1.3.1.1	Instructor Time
1.3.1.1.1	Military- Active
1.3.1.1.2	Military - Reserve 1.3 Improved Productivity
1.3.1.1.3	Civilian
1.3.1.2	Student Time
1.3.1.2.1	Military- Active
1.3.1.2.2	Military - Reserve
1.3.1.2.3	Civilian
1.3.2	Value-Added Time Away from Non- Aircrew Training
1.3.2.1	Instructor Time
1.3.2.1.1	Military- Active
1.3.2.1.2	Military - Reserve
1.3.2.1.3	Civilian
1.3.2.2	Student Time
1.3.2.2.1	Military- Active
1.3.2.2.2	Military - Reserve
1.3.2.2.3	Civilian
2.0	Quantifiable Non-Monetary
2.1	Improvement in Error Rate
2.2	Faster Response Time to New Requirements
3.0	Non-Quantifiable
3.1	Quality of Life
3.2	Morale

Majority of the BES is made up of “1.0 Quantifiable Monetary” benefit elements – either 1.1 Cost Savings or 1.3 Improved Productivity

NOTE: BES was designed to measure *incremental* benefits, or benefits *relative to the Baseline Alternative*

Avoiding Double-Counting in BES

- Important not to double-count. For example, Cost Savings (1.1 Benefit Elements) can easily be represented as a reduction in certain cost elements in the CES
- We followed CEBoK guidance and chose to address Cost Savings in the cost estimate and Improved Productivity in the benefits estimate
 - Cost Savings are still represented in the BES, but the dollar amount is shown as \$0
 - Cost Savings BES elements are closely tied to the CES elements where the savings are shown

Example: Content Delivery (Aircrew Training)

BES

Code	Description
1.1.1.1	Cost Savings - Content Delivery (Aircrew Training)
1.1.1.1.1	Facilities
1.1.1.1.2	Travel/TDY
1.1.1.1.3	Refreshments/Catering
1.1.1.1.4	Contractor Instructor Labor

2.2.1	Content Delivery (Aircrew Training)
2.2.1.1	Software Deployment
2.2.1.2	Facilities
2.2.1.2.1	Rented Facilities
2.2.1.2.2	Owned Facilities
2.2.1.3	Instructor Labor
2.2.1.3.1	Military - Active
2.2.1.3.2	Military - Reserve
2.2.1.3.3	Civilian
2.2.1.3.4	Contractor
2.2.1.4	Student Labor
2.2.1.4.1	Military - Active
2.2.1.4.2	Military - Reserve
2.2.1.4.3	Civilian
2.2.1.4.4	Contractor
2.2.1.5	Travel/TDY
2.2.1.6	Catering and Refreshments

CES

Each of the Cost Savings BES elements map to a corresponding CES element where the cost savings are captured in the cost estimate for the To-Be Alternative

Data Collection Instrument (DCI)

- Developed DCI to facilitate collection of the Baseline Alternative costs
- Only 2.0 Operating & Support elements apply to the Baseline
- Initial conversations with stakeholders indicated they would prefer to report costs at a higher level and “allocate” those costs to lower-level elements using percentages
 - Time and effort to collect cost data at the lowest levels too great
- Excel-based instrument includes:
 - Interactive tree structure containing all 2.0 cost elements
 - Input areas for costs and percent allocations
 - Detailed definitions for all cost elements
 - Sample cost drivers (variables) for each cost element, that the stakeholder can provide in the absence of actual cost data (e.g., for Travel/TDY costs, stakeholder can provide “number of trips (and people traveling) per year, with starting and ending locations, and duration”)

Data Collection Instrument (DCI)

Tree structure containing the cost elements expands/collapses

Enter Baseline costs for "level 2" cost elements

Please click on each header for additional detail about the contents of each column, and click on input (yellow/white) cells for additional instructions on how to complete the cells.
Please use the "+" and "-" toggles in the left-hand column to expand and collapse the structure as needed.

LEVEL	CE #	CE NAME	BASELINE COST (FY 2014 \$K)	LEVEL 2 ALLOCATION & SUM	LEVEL 3 ALLOCATION & SUM	LEVEL 4 ALLOCATION & SUM	VARIABLES FOR ESTIMATING COST (optional)
2	2.1	Program Management	\$100,000	100%			
3	2.1.1	Military - Active		10%			
3	2.1.2	Military - Reserve		10%			
3	2.1.3	Civilian		0%			
3	2.1.4	Contractor		20%			
3	2.1.5	Travel/TDY		30%			
3	2.1.6	Other Program Management		30%			
2	2.2	Content Delivery		0%			
2	2.3	Content Maintenance and Updates		0%			
2	2.4	Hardware Maintenance & Management					
2	2.5	Software Maintenance					
2	2.6	Help Desk/Service Desk & PDSS					
2	2.7	Technology Refresh		0%			
2	2.8	Recurring Fees		0%			
2	2.9	Data Security					
2	2.10	Technical/SME Support					
2	2.11	Other Operating and Support					

Provide allocations percentages for remaining, lower-level cost elements

If stakeholder cannot provide costs, instrument provides guidance on what variables to provide for each cost element (to help us estimate)

CE #	CE Name	Lowest Level	Sample Variables
2.0	Operating and Support		
2.1	Program Management		
2.1.1	Military - Active	X	Number of active military FTEs, by rank, performing program management functions for learning/training
2.1.2	Military - Reserve	X	Number of reserve military FTEs, by rank, performing program management functions for learning/training
2.1.3	Civilian	X	Number of civilian FTEs, by grade, step, and locality, performing program management functions for learning/training
2.1.4	Contractor	X	Total dollar amount of contracts associated with program management functions for learning/training
2.1.5	Travel/TDY	X	Number of trips per year, by starting location, destination, duration, and number of people, associated with program management f
2.1.6	Other Program Management	X	Any other learning/training program management costs, beyond the "go live" date of within-scope courses, not accounted for elsew
2.2	Content Delivery		
2.2.1	Content Delivery (Aircrew Training)		
2.2.1.1	Software Deployment	X	Description of software specific to the delivery of training content that must be deployed and configured, frequency of deployment
2.2.1.2	Facilities		

Using the DCI - Issues

- Further conversations with more stakeholders revealed that each group has different data collection limitations:
 - Proprietary information (e.g. contract data)
 - Level of detail at which cost data exists varies by organization
- Many questions came up about the *scope* of the analysis – what to include or not include
 - What if part of the training is funded by another organization outside AMC?
 - What about training that does not have a defined curriculum/syllabus?
- Found that we needed some additional context about the data we received in order to avoid issues with double-counting and/or not including everything
 - Do the costs being provided represent everything for training? If not, what percentage is represented?
 - Are any other organizations within (or outside) AMC funding part of the costs?

Using the DCI – Addressing the Issues

- Developed **customized DCIs** for each stakeholder group that can be mapped back to the same CES

Example: DCI customized to collect cost data at the lowest possible cost element

LEVEL	LOWEST LEVEL	CE #	CE NAME	LEVEL 2 BASELINE COST (FY 2014 \$K)	LEVEL 3 BASELINE COST (FY 2014 \$K)	LEVEL 4 BASELINE COST (FY 2014 \$K)	LEVEL 5 BASELINE COST (FY 2014 \$K)
2		2.1	Program Management	\$0.0			
3	X	2.1.1	Military - Active				
3	X	2.1.2	Military - Reserve				
3	X	2.1.3	Civilian				
3	X	2.1.4	Contractor				
3	X	2.1.5	Travel/TDY				
3	X	2.1.6	Other Program Management				
2		2.2	Content Delivery	\$0.0			
2		2.3	Content Maintenance and Updates	\$0.0			
2	X	2.4	Hardware Maintenance & Management				
2	X	2.5	Software Maintenance				
2	X	2.6	Help Desk/Service Desk & PDSS				
2		2.7	Technology Refresh	\$0.0			
2		2.8	Recurring Fees	\$0.0			
2	X	2.9	Data Security				
2	X	2.10	Technical/SME Support				
2	X	2.11	Other Operating and Support				

Enter costs at the lowest level; DCI automatically sums the parent-level elements (no percent allocations)

- Created **Scope Document** that provides a clear definition of the “universe” of costs to collect and guidance for handling different types of scenarios (e.g. how to handle AMC-funded training costs for non-AMC students)
- Developed list of “**Context Questions**” that we asked stakeholders to answer along with their data submission (e.g. “What is the current expectation for how each of the costs will change over the next 10 years?”)

Collecting Data for To-Be Alternative

- Approach for estimating costs
 - Investment & Decommissioning costs (unique to the To-Be Alternative) estimated based on market research of similar transformation initiatives
 - Operating & Support costs were estimated as deltas from the Baseline costs, based on:
 - Market research on expected cost savings or increases where applicable
 - Algorithms using parameters about the new environment created by the To-Be Alternative (e.g. percentage of training that will be classroom-based vs. virtual)
- Approach for quantifying benefits
 - All benefits except Productivity Improvements captured on the cost side
 - Market research of the productivity changes the To-Be Alternative will create (e.g. what the reduced instructor time per course will be)
 - Algorithms using parameters about the new environment created by the To-Be Alternative (e.g. percentage of training that will be classroom-based vs. virtual)

BCA Implementation

- Purpose of the Business Case Analysis (BCA) is to recommend a ***preferred alternative***, based on a comparative analysis of the costs and benefits of the Baseline and To-Be Alternatives
 - We chose to limit the scope of our BCA to only *monetized* costs and benefits (All costs in the CES and the 1.0 elements in the BES)
 - Used a 10 year period of analysis
- Analysis requires a Cost Benefit Model with the following components:
 - Ability to alter parameters and assumptions around the alternatives to “test” different scenarios
 - Costs and benefits of each alternative phased by FY, adjusted for inflation, and discounted to represent the data in present value terms
 - “Then-Year” costs of each alternative phased by FY to be used for budgeting
 - Automatic calculation of “measures of merit” used to evaluate the To-Be Alternative

Summary:

BCA Cost & Benefits by Alternative

		Baseline Alternative	To-Be Alternative
Costs	1.0 Investment	None	✓
	2.0 Operating & Support	✓	✓ <i>Note: Defaults to Baseline cost unless there is an identified cost delta</i>
	3.0 Decommissioning	None	✓
Benefits (Quantifiable Monetary)	1.1 Cost Savings	None <i>Note: All benefits are measured relative to the Baseline</i>	✓ <i>Note: Shown as \$0 in the BES, as they are captured as cost savings in the 2.0 portion of the CES</i>
	1.3 Productivity Improvements		✓

BCA - Parameters

Cost Benefit Model has four main parameters tabs containing data that the user may enter/modify:

- **General Parameters** – contains global parameters such as the OMB discount rates used to calculate discounted, Present Value (PV) dollars
- **Baseline Alternative 2.0 Costs** – contains all 2.0 Operating & Support costs for the Baseline, collected via the DCI, in FY 2015 \$
- **To-Be Alternative 1.0 and 3.0 Costs** – contains estimated 1.0 Investment and 3.0 Decommissioning costs for the To-Be Alternative, in FY 2015 \$
- **To-Be Alternative Benefits & 2.0 Cost Savings** – contains the estimated monetary value of both Productivity Improvements and 2.0 Operating & Support Cost Savings, calculated based on user-entered parameters (e.g. old vs. new mix of virtual vs. classroom training)
 - Also contains ability to modify the schedule for phasing in cost savings and productivity improvements (e.g. 0% of savings realized in first year, 50% realized in second year, etc.)

BCA – Parameters (cont.)

NOTIONAL DATA ONLY

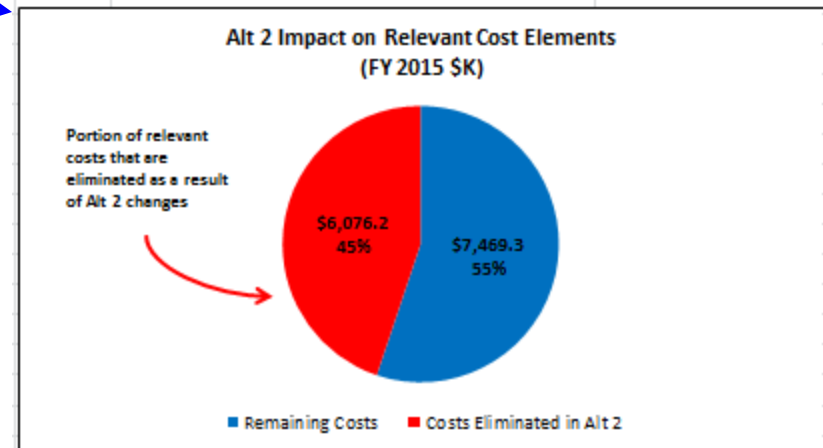
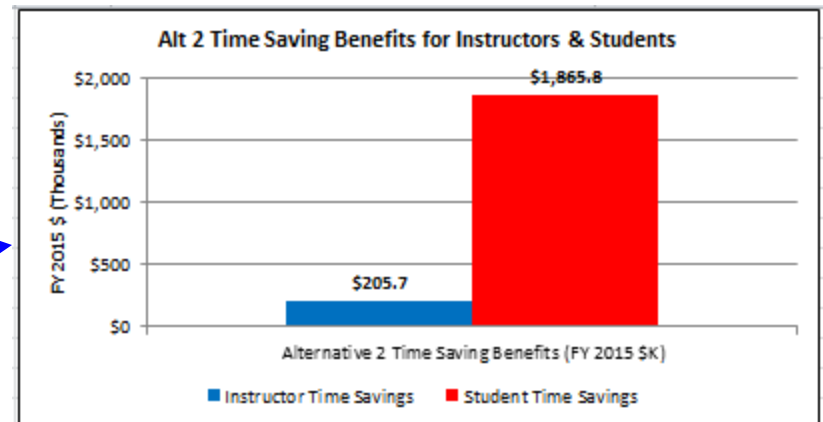
To-Be Alternative Benefits & 2.0 Cost Savings Parameters

See how it impacts the value of Productivity Improvements & Cost Savings

Modify Parameters

Aircrew Training - all parameters below apply only to Aircrew Training courses	
# of Classes	160
% Classroom-Based (Existing - Alt 1)	80%
% Virtual - Self-Paced (Existing - Alt 1)	10%
% Virtual - Structured Setting (Existing - Alt 1)	10%
Sum of Alt 1 %s	100%
% Classroom-Based (To-Be Alt 2)	50%
% Virtual - Self-Paced (To-Be Alt 2)	30%
% Virtual - Structured Setting (To-Be Alt 2)	20%
Sum of Alt 2 %s	100%
Reduction in Student time - Virtual Self-Paced	140
Reduction in Instructor time - Virtual Self-Paced	20
Reduction in Student time - Virtual Structured Setting	20
Reduction in Instructor time - Virtual Structured Setting	5

Note: For illustration purposes, only a subset of parameters shown here



NOTE: All data are notional

BCA – Costs & Benefits

NOTIONAL DATA ONLY

- Calculated both Cost and Benefit BY and PV dollars by element and FY (2015-2024)
 - BY \$ remove the effects of inflation and put all dollars in terms of one base year (2015)
 - PV \$ are needed to account for the time value of money, in order to equitably compare the two alternatives
- Calculated only Cost TY dollars by cost element and FY (2015-2024) – *to be used with the chosen alternative for budgeting*

Each cost element mapped to an appropriation type in order to calculate TY dollars using the Air Force inflation rates provided by appropriation

CE Name	\$K	\$K	\$K	\$K	\$K	\$K	\$K	\$K	\$K	\$K	\$K	Appropriation
	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	Total	
Use of Training Devices	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	3400 - O&M
Consumables	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	3400 - O&M
Energy/POL	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	3400 - O&M
Content Delivery (Non-Aircrew Training)	\$18,104.1	\$18,243.6	\$18,402.3	\$22,933.3	\$25,741.0	\$25,961.5	\$26,186.8	\$26,417.0	\$26,652.3	\$26,892.8	\$235,534.7	
Software Deployment	\$1,800.0	\$1,800.0	\$1,800.0	\$2,700.0	\$3,240.0	\$3,240.0	\$3,240.0	\$3,240.0	\$3,240.0	\$3,240.0	\$27,540.0	0000 - Civilian Pay
Facilities	\$918.9	\$936.4	\$954.2	\$972.3	\$990.8	\$1,009.6	\$1,028.8	\$1,048.3	\$1,068.2	\$1,088.5	\$10,885.5	
Rented Facilities	\$459.5	\$468.2	\$477.1	\$486.1	\$495.4	\$504.8	\$514.4	\$524.2	\$534.1	\$544.3	\$5,008.0	3400 - O&M
Owned Facilities	\$459.5	\$468.2	\$477.1	\$486.1	\$495.4	\$504.8	\$514.4	\$524.2	\$534.1	\$544.3	\$5,008.0	3400 - O&M
Instructor Labor	\$3,618.9	\$3,648.8	\$3,684.0	\$4,453.9	\$4,937.0	\$4,989.2	\$5,042.6	\$5,097.2	\$5,153.1	\$5,210.2	\$45,835.0	
Military - Active	\$900.0	\$908.9	\$921.3	\$944.0	\$967.3	\$991.2	\$1,015.6	\$1,040.7	\$1,066.3	\$1,092.6	\$9,847.9	3500 - Military Pay
Military - Reserve	\$360.0	\$363.6	\$368.5	\$377.6	\$386.9	\$396.5	\$406.2	\$416.3	\$426.5	\$437.0	\$3,939.1	3500 - Military Pay
Civilian	\$1,440.0	\$1,440.0	\$1,440.0	\$2,160.0	\$2,592.0	\$2,592.0	\$2,592.0	\$2,592.0	\$2,592.0	\$2,592.0	\$22,032.0	0000 - Civilian Pay

NOTE: All data are notional

BCA – Measures of Merit

Model automatically calculates four Measures of Merit used to evaluate the To-Be Alternative:

Measure	Purpose	Interpretation	Calculation
Net Present Value (NPV)	Represents the discounted value of expected net benefits over the period of analysis (10 years)	Higher = Better, >\$0 is favorable	$NPV^1 = PV(\text{Benefits}) - PV(\text{Incremental Cost})$
Savings/ Investment Ratio (SIR)	Highlights the relationship between financial benefits and the investment needed to achieve those benefits	Higher = Better, >1.00 is favorable	$SIR = [PV(\text{Benefits}) - PV(\text{Incremental Cost})] / PV(\text{Investment})$

1. Note: While CEBoK calculates this measure using all costs and benefits of each alternative (and then compares), we chose to only look at incremental costs and benefits of the To-Be Alternative. This convention makes the NPV of the Baseline \$0, by definition.

BCA – Measures of Merit (cont.)

Model automatically calculates four Measures of Merit used to evaluate the To-Be Alternative:

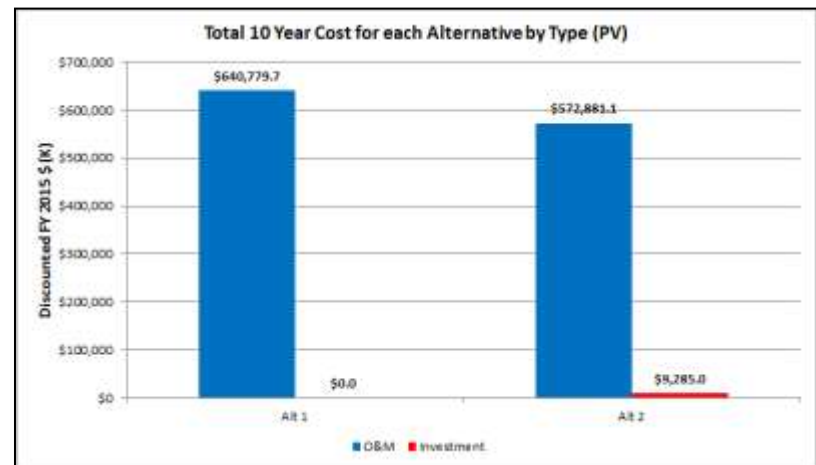
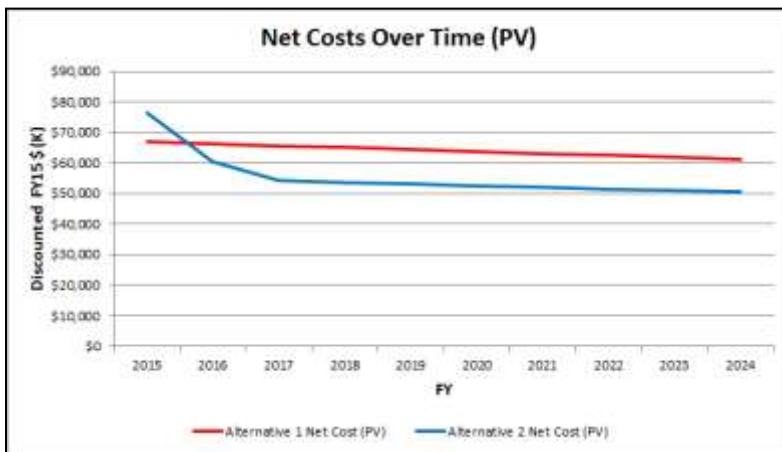
Measure	Purpose	Interpretation	Calculation
Discounted Payback Period	Determines the length of time needed for an alternative to realize enough savings to offset the investment costs	Lower = Better	Calculated by finding the time needed (in years) for PV(Cumulative Savings) to exceed PV(Cumulative Investment) (we automated in Excel)
Real Internal Rate of Return (IRR)	Capture the merit of the alternative as a single percentage value – the real discount rate which makes NPV = 0	Should be positive in order to be considered a worthy alternative Higher = Better	Excel function calculates the % based on the Net Value (BY) of the To-Be Alternative in each year of the period of analysis

Preliminary Results

NOTIONAL DATA ONLY

To-Be Alternative Measures of Merit

Measure	Value	Interpretation
Net Present Value (NPV)	\$85,497.7K	Over 10 years, the expected present value of net benefits provided by the To-Be Alternative is over \$85M
Savings/ Investment Ratio (SIR)	10.21	There is a greater than 10:1 ratio between the financial benefits of the To-Be Alternative and the investment needed to achieve those benefits over the 10 year period
Discounted Payback Period	2.3 years	It will take a little over 2 years for the investment in the To-Be Alternative to pay for itself, in discounted dollars
Internal Rate of Return (IRR)	95%	A 95% real discount rate would be needed to make the NPV=0



NOTE: All data are notional

Conclusion

- Transforming AMC into a premier Air Force learning organization through optimum approaches to training requires an analytically sound BCA in order to:
 - Obtain a clear measurement of the costs and benefits of the transformation relative to the “current state of the world”
 - Justify the initial investment needed to implement the transformation
- We have established a *new standard* for estimating training costs and conducting a comparative analysis of training investment alternatives
 - Created comprehensive CES and BES exclusively for training
 - Developed BCA (and supporting Cost Benefit Model) that is well-documented, traceable, and repeatable—in a framework uniquely suited to evaluation of alternative training investments and frameworks