



**Automated Cost Estimating
Integrated Tools**

GM-107

ACEIT TECHNICAL PAPER
“Inflation Handling in ACE”

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December 2005



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ABSTRACT

Inflation is a common consideration when developing cost estimates. ACE is used by a large number of Government and Commercial organizations to develop cost estimates. Within ACE is the capability to access System-provided inflation indices to allow for common application of inflation indices.

As ACE is used by a wide range of users, there is a large interest in understanding the source of ACEIT inflation indices and the process used to update the inflation indices in ACEIT. Also of high interest is understanding the ultimate sources of these indices and differences (if any) between them in their final calculations.

This document will describe the inflation process in ACE, define inflation, explain the sources of inflation, and document the inflation calculations used by the various services.

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1: INTRODUCTION

Every estimate must consider the impact of inflation. Inflation is defined as an increase in the amount of currency in circulation that results in an increase in the general level of prices. When estimates are developed and phased over time, the analyst must determine the amount needed to fund or pay for the project. To facilitate assessing the impact of inflation, analysts build inflation indices to allow quick translation between costs in different years. An inflation index represents a percentage comparison of inflation from a fixed point of reference.

In this document, we describe the process for calculating the inflation indices provided in ACEIT for the following services: Army, Air Force, Navy/USMC, and Defense Agency. Most of the other sources of indices deal only with raw inflation indices; no outlays are used, so the inflation is straight-forward and easy to calculate, however these core services calculate both raw and weighted indices. Raw indices are based on escalation/inflation rates only (i.e., the year-to-year rate of change in prices); weighted indices are based on the escalation rates in conjunction with planned outlay profiles for the different commodities.

2: ACEIT INFLATION INDICES

Tecolote has been collecting and publishing OSD inflation indices for use within ACEIT since 1993. In the early years, rates were manually calculated based on escalation factors and outlay rates/profiles. In recent years, indices have been taken directly from the source documents provided by each service and entered directly into the ACE tables. ACE currently stores both raw and weighted indices for all appropriations through the year 2100. The starting year of the indices within ACEIT vary depending on the actual index; the earliest rates go back to 1955, and some rates only go back to 1990.

ACEIT provides updated system inflation tables several times during a year. Updates are posted frequently in the first three or four months of each year as they become available. This is due to the fact that the source inflation indices by agency are available at different times and some agencies (i.e., Navy/USMC) provide rates in “batches” – first the basic rates become available, then the composite rates a couple of months later. The Army rates are typically provided to Tecolote first and published as soon as available. As each service/agency provides rates to Tecolote, the ACEIT system inflation tables are updated and made available to all users with current DMS/License..

2.1 SOURCES FOR ACEIT INFLATION INDICES

Over the years, more and more services have provided indices to include within ACEIT; ACEIT now contains indices from eleven different sources. Table 1 shows the sources for ACEIT inflation.

Service/Agency	Time Frame	Source	POC
Army			
Basic	Jan/Feb	AMC via e-mail	Harvey Mymit
Historical/Others	Jan/Feb	http://www.asafm.army.mil/budget/di/di.asp	
Air Force	Jan/Feb	https://aftoc.hill.af.mil/AFI65503/AFI65503.html	Kim Taylor
Navy/USMC			
Basic	Jan/Feb	http://www.ncca.navy.mil/services/inflation.cfm	Robert Hiram

Service/Agency	Time Frame	Source	POC
Composite	Mar/Apr	http://www.ncca.navy.mil/services/inflation.cfm	Robert Hirama
Defense Agency	Jan/Feb	MDA via e-mail	Robert Grillo
NAVSEA/MARAD	Jan/Feb	NAVSEA via e-mail	Lisa Pfeiffer
NASA	Jun/Jul	https://secureworkgroups.grc.nasa.gov	Joe Hanamaker
FAA	Sep/Oct	FAA via e-mail	Brian Greenfest
Coast Guard	Summer	Deepwater via e-mail	S. M. Lacey
DoFA	Oct/Nov	Australian Defense Agency via e-mail	Damian Gilchrist

Table 1: Sources of Inflation Indices

2.2 DATA STORED IN ACEIT INFLATION TABLES

ACE stores raw (compound) and weighted (composite) indices in the current base year out to the year 2100. It does not store the annual year-to-year escalation nor the outlay profiles within the inflation database. This means that the 2005 inflation indices are stored in base year 2005. Different indices have different beginning years. For example, the AF rates are typically stored back to 1955. Most of the Army rates go back to 1960, however, the MPA rates only go back to 1980. Note that in addition to the current year's rates, all historical rates are included in the inflation updates that are placed on the web. Consequently, the size of the downloadable file is often greater than 10MB.

2.3 TIMEFRAME FOR PUBLISHING ACEIT INFLATION RATES

Typically, the Army rates are the first to be published. AMC creates the consolidated MPA rate used in ACE, and the Army Budget Office usually creates the other indices. These rates are pasted into proper ACE format and tested in Tecolote's Quality Assurance (QA) department before being posted on the www.aceit.com website. The AF, Defense Agency (MDA) and Navy/USMC are usually next. Once again, published rates are pasted into ACE format files for distribution. The Navy/USMC update is in two steps. The basic indices are updated first; months later, the composite rates are updated. The other indices are updated as they become available.

2.4 SOURCES OF DOD INFLATION RATES

The U.S. Treasury, the Council of Economic Advisors and the Office of Management and Budget set federal government inflation policy. This includes issuing inflation rates for all federal departments and agencies for use in their planning and budgeting. Within the DoD, the Office of the Under Secretary of Defense (Comptroller) uses OMB directed inflation rates to develop inflation guidance for the military Services. All DoD services use the OSD Inflation Guidance memo which is usually published in January each year. This year's memo, entitled "Inflation Guidance – Fiscal Year (FY) 2006 President's Budget" and dated Feb 3, 2005 lists escalation rates and pay raise assumptions for an 8-year period (e.g., 2004-2011). In addition, outlays rates are supplied for each service's various appropriations.

2.4.1 ARMY INFLATION RATES

Within the Army, the Army Budget Office, SAFM-BUC-F, is the lead office for inflation and real growth/real spending computation for the Department of the Army. The official Army non-pay inflation indices are developed by this office for use in Army documents throughout the OSD/OMB Budget Estimates Submission (BES) and President's Budget, Selected Acquisition Reports (SAR) and Program Objective Memorandum (POM) processes. Official inflation indices and other inflation data are published annually (usually in January or February) and are available from this office. They are published in hard copy and are electronically available on the Data Analysis Query System (DAQS). Tecolote obtains these rates, puts them into the proper format for use in ACEIT and uses them as the Army inflation indices.

Previously, Tecolote received electronic versions of the current year rates from two different sources: AMC provided the Consolidated Military Personnel rates, and the Army Budget Office provided all the others. Beginning in 2005, Tecolote created the raw and weighted indices by using the published escalation rates and the current and historical outlay rates for all the rates except for Consolidated Military Personnel, which was still received from AMC.

2.4.2 AF INFLATION RATES

Within the AF, the Secretary of the AF (SAF/FMCE) through the Directorate of Economics and Business Management is responsible for developing and maintaining raw and weighted inflation

indices that are consistent with the prevailing USD(C) position. New inflation rates are ordinarily published in January each year, in time for the President's Budget and SAR submission. New fiscal year outlay profiles are published in time for the AF POM submission to DoD. The AF revises its official inflation rates whenever directed by OSD. The inflation rates used to develop the tables reflect mid-fiscal year (April 1) to mid-fiscal year price changes. OSD inflation rates published for the out-years (forecasts) may seem low when compared to private sector economic (econometric) forecasts. This derives from the administration issuing inflation rates that reflect policy goals rather than a consensus of forecasters.

Tecolote downloads the current year indices every year from the AF SMC web site. These rates are put into the proper format for use in ACEIT. Tecolote does not use the escalation rates and outlay profiles to manually calculate these rates.

2.4.3 NAVY/USMC INFLATION RATES

Within the Navy, inflation guidance is provided annually by OSD, usually in late January, by memorandum from USD (Comptroller), Subject: Inflation Guidance. However, in the past, OSD has provided this memo as much as three months late. The memo can be obtained from Ms. Marie Curtain, OSD Comptroller staff. An attachment to this memo contains "Price Escalation Indices" or inflation rates for the FYDP and two prior years, for 8 non-pay cost elements and 3 pay elements. The rates given for the final year of the FYDP are to be used for all subsequent years.

Tecolote downloads the current year indices from the NCCA web site. These rates are put into the proper format for use in ACEIT. Tecolote does not use the escalation rates and outlay profiles to manually calculate these rates.

2.4.4 MISSILE DEFENSE AGENCY RATES

Within MDA, the indices are derived from the DoD Comptroller's memorandum entitled "Inflation Guidance – Fiscal Year (FY) 2006 President's Budget" dated February 3, 2005.

Tecolote receives these rates by e-mail. They are put into proper format for use in ACEIT.
Tecolote does not use the escalation rates and outlay profiles to manually calculate these rates.

3: INFLATION CALCULATIONS

All services use the OSD Inflation Guidance memo, which is usually published in January of each year, as the basis for calculating inflation indices. All services use the rates in the “Outlays” section, not the “Budget Authority” section to calculate raw (compound) indices. They use the Procurement (purchases) and O&M Fuel rates. All services calculate raw (compound) indices in the same manner. Consequently, raw indices are typically the same or very close across all services. The escalation rates published each year show escalation from the prior year through the next 7 years. For example, in the inflation guidance published in 2005, escalation rates are shown from 2004 – 2011. Consequently, raw indices can and do change for the prior year in addition to the current and future years.

3.1 CALCULATING RAW (COMPOUND) INDICES

Raw Indices are based on OSD-prescribed inflation rates (percent changes from the midpoint of one year to another). These rates typically include escalation indices from the prior year through the following six years. For example, the escalation indices published in January 2005 include escalation rates from 2004 - 2011. The rates in 2011 are used to calculate any future indices. The following formula illustrates the method all the services use to calculate raw inflation indices:

$$RI(i+n) = RI(i) * (1 + rate(i+1)) * (1 + rate(i+2)) * \dots * (1 + rate(i+n))$$

Where RI(i) = Raw Index of the Base Year (expressed as 1.0)

Rate(i+1) = inflation rate from base year to the following year, expressed as a decimal (i.e., 5.5% = .055)

RI(i+n) = Raw Index for the desired year

Sample Calculation of Raw Inflation Index

Fiscal Year	Inflation Rate (%)	Inflation Index (FY78 = 1.0)
1979	6.2	1.062
1980	6.3	1.129
1981	5.8	1.294
1982	5.5	1.260
1983	5.5	1.329
1984	5.5	1.402

The FY81 raw inflation index = $1.0 * (1 + 0.062) * (1 + 0.063) * (1 + 0.058) = 1.194$

The following table shows a list of all appropriations that use the column entitled “Proc.” in the Outlays section of the OSD inflation guidance. Consequently, the raw inflation indices for all these appropriations match.

Army	Navy	USMC	AF	Def Agency
2040 (RDTEA)	1318 (RDTEU)	1109 (PMC)	3600 (RDTEF)	0400 (RDTED)
2031 (APA)	1506 (APN)	1508 (PANMC)	3010 (APF)	0300 (OPD)
2032 (MIPA)	1407 (WPN)		3020 (MIPF)	0500 (MCOND)
2033 (WTCV)	1611 (SCN)		3080 (OPF)	0100 (OMD)
2034 (AMMO)	1810 (OPN)		3300 (MCONF)	
2035 (OPA)	1206 (MCN_U)		3400 (OMF)	
2020 (OMA)	1805 (OMN_U)		3401 (OMF_P)	
2080 (OMAR)			3730 (MCF_R)	
2065 (OMANG)			3830 (MCF_G)	
2050 (MCA)				
2086 (MCAR)				
2085 (MCANG)				
0810 (DERA)				
0390 (CDA)				
7025 (AFHO)				
7020 (AFHC)				

The Navy index 1806 (OMN_F) and the AF index 3402 (OMN_F) both use the rates from the column entitled "O&M Fuel". Both these indices are identical.

3.2 CALCULATING WEIGHTED (COMPOSITE) INDICES

Weighted indices are based on escalation indices and outlay profiles/rates. Outlay rates are published along with escalation indices in the same document. The various services use the outlays in different years and use different formulas to calculate weighted indices. There are two main formulas used by the services to calculate weighted indices.

The Navy, AF and Defense Agency calculate weighted indices using the following formula.

$$WI(i) = 1/((OR(i) / RI(i)) + (OR(i+1)/ RI(i+1)) + \dots + (OR(i+k)/RI(i+n)))$$

Where WI(i) = weighted index for the year i

OR(i) = outlay rate for year i expressed as a decimal (i.e., 40% = .4)

RI(i) = raw inflation index for year i expressed with a base of 1.000

i+k = last year in the outlay profile.

i+n = n years after year i

Sample Calculation of Weighted Inflation Index

Fiscal Year	Raw Inflation Index	Outlay Rates (%)
1979	1.000	10
1980	1.062	40
1981	1.121	30
1982	1.182	12
1983	1.246	5
1984	1.313	3

The FY 1979 weighted inflation index = $1/[(.1/1.0) + (.4/1.062) + (.3/1.121) + (.12/1.182) + (.05/1.246) + (.03/1.313)] = 1.100394$

The Army uses the following formula to calculate weighted (composite) indices:

$$WI(i) = ((OR(i) * RI(i)) + (OR(i+1) * RI(i+1)) + \dots + (OR(i+k) * RI(i+n)))$$

Where WI(i) = weighted index for the year i

OR(i) = outlay rate for year i expressed as a decimal (i.e., 40% = .4)

RI(i) = raw inflation index for year i expressed with a base of 1.000

i+k = last year in the outlay profile.

i+n = n years after year i

Using the data above, the FY 1979 weighted inflation index = (.1*1.000 + .4*1.062 + .3*1.121 + .12*1.182 + .05*1.246 + .03*1.313) = 1.10463

3.3 FORMULA TO CALCULATE PAY RAISES

From the Pay Raise Assumptions section, the services use the Military and Civilian pay escalation rates. OSD provides the military and civilian pay raise effective Jan. 1. To be consistent with the budget and other cost elements, the services must convert these to a fiscal year basis. There are two methods used for this conversion. The Air Force uses the first method, defined by the formula:

$$\text{Formula 1: FY2 raise} = \frac{1 * R1 + 3 * R2}{4}$$

Where R1 = pay raise that becomes effective Jan 1 of FY1

R2 = pay raise that becomes effective Jan 1 of FY2

Note: FY2 pay consists of 3 months of R1 (Oct-Jan) and 9 months of R2 (Jan-Sep).

The Navy uses the following formula to calculate Military and Civilian pay escalation rates:

$$\text{Formula 2: FY2 raise} = \frac{1 + 3 * R2}{4}$$

$$1/R1 + 3$$

Where R1 = pay raise that becomes effective Jan 1 of FY1

R2 = pay raise that becomes effective Jan 1 of FY2

Note the rates R1 and R2 are entered in the form 1.0X. For example a 4% rate would be entered as 1.04.

The table below shows the various Military Personnel indices in ACE.

Army	Navy	USMC	AF
2010 (MPA)	1453 (MPN)	1105 (MPMC)	3500 (MPF)
	1454 (MPN_N)	1108 (RPMC)	3501 (MPF_P)
	1455 (MPN_P)		3502 (MPF_O)
	1807 (OMN_P)		3503 (MPF_R)

The Army's MPA rate is a consolidated rate that includes both Military Pay and Non-Pay items. The Military Pay rates are not normalized to fiscal year, but are used as is from the OSD guidance. According to Matthew Peck, who created the 2005 AMC rates, the consolidated military personnel rates use the following breakout between Military Pay and Non-Pay items: Mil-Pay .943, Non-Pay .057. These breakouts have been used since 1994.

The Navy rates for military personnel (MPN) are a composite that include some portion of Military Pay (MPN_P), Reserve Pay, Non-Pay (MPN_N) and Other Pay elements. The Non-Pay military personnel (MPN_N) uses the same rates as the other raw indices use and has outlays that are used to calculate weighted indices. The standard military pay appropriation (MPN) uses the pay raises that have been normalized using formula 2 above. The civilian pay appropriation (OMN_P) uses the civilian pay raises that have also been normalized using formula 2.

The USMC rates are both composite indices. The military personnel (MPMC) rate is a combination of Military Pay (MPN_P), Reserve Pay, Non-Pay (MPN_N) and Other Pay. The reserve military personnel (RPMC) indices are also a combination of the same elements but in different ratios.

The AF military personnel indices (MPF) are a combination of various elements. We have not yet been able to determine exactly which combination of rates is used to create the MPF appropriation. The pay base rate (MPF_P) is calculated based on pay raises specified in the OSD guidance and normalized using formula 1 above. We have also not yet been able to determine which rates are used to calculate military pay other expenses (MPF_O) and military pay retirement pay (MPF_R).

4: DIFFERENCES BETWEEN SERVICES IN USING OUTLAY RATES

A difference between each service is what year the published outlay rates are applied. The AF uses the current year published outlay rates to calculate weighted indices for the prior year as well as future years. As a result, the permanent weighted inflation rates for historic years are based on the outlay profile that was published by OSD one year later. For example, the rates published in 2005, entitled “Inflation Guidance Fiscal Year (FY) 2006 President’s Budget” would be used to calculate the weighted index from 2004 on. The Navy uses the current published outlays to calculate weighted indices for the prior two years as well as future years. The Defense agency uses them for the previous 3 years on, and the Army uses them for the next year on (i.e., 2005 rates are used to calculate compound indices from 2006 on).

The following table shows an excerpt of information from the Feb 3, 2005 OSD guidance entitled “Inflation Guidance – Fiscal Year (FY) 2006 President’s Budget”. The shaded rows denote information retrieved from historical data.

PRICE ESCALATION IN		Procurement	Outlay Rates to be used for Incremental Changes in BA Purchases						
Fiscal Year	OUTLAYS Proc.		First Year	Second Year	Third Year	Fourth Year	Fifth Year	Sixth Year	Seventh Year
2002	0.8	AF Aircraft	26.5	47.1	16.7	5.2	2.3	2.2	
2003	1	Navy Ships	15	25.8	15.57	14.16	11.25	8.17	10.05
2004	2	Army Aircraft	19	48	21.5	5.5	3	3	
2005	2	Defense Wide Proc.	25	41	22.9	8.2	2.9		
2006	2								
2007	2.1								
2008	2.1								
2009	2.1								
2010	2.1								
2011	2.1								

The table below shows the first year that uses the outlays shown above. This beginning year is different across the services. A single appropriation within a service was selected as an example, but all appropriations within a particular service are calculated the same way.

	All Services	Navy	AF	Army	Defense Agency (MDA)
Fiscal Year	Raw Indices	SCN Wtd (1611)	3010 Wtd (APF)	APA Wtd (2031)	OPD Wtd (0300)
2001					
2002	0.951652259				0.967795284
2003	0.961168781	1.008898452			0.984699007
2004	0.980392157	1.029499881	1.003156702		1.004497847
2005	1	1.050683526	1.023476818		1.024921088
2006	1.02	1.072582153	1.044692044	1.049201268	1.046181624
2007	1.04142	1.095106378	1.066630577	1.071234495	1.068151438
2008	1.06328982	1.118103612	1.089029819	1.093730419	1.090582618
2009	1.085618906	1.141583788	1.111899445	1.116698758	1.113484853
2010	1.108416903	1.165557048	1.135249334	1.140149432	1.136868035
2011	1.131693658	1.190033746	1.15908957	1.16409257	1.160742264
	1.155459225				
	1.179723869				
	1.20449807				
	1.229792529				
	1.255618173				
	1.281986154				

5: BASIC RULES FOR USING INFLATION INDICES

The following lists basic rules and assumptions to follow when using raw and weighted inflation indices.

5.1 USING RAW VS. WEIGHTED INDICES

The following rules apply to using raw versus weighted indices:

- Use raw indices to convert constant dollars in one year to constant dollars in another year.
- Use weighted indices to convert base-year (constant) dollars to then-year TOA dollars, and conversely, to convert then-year TOA dollars to base-year (constant) dollars. Weighted indices apply to situations where money is not completely expended in the year for which it is obligated, that is, where an outlay pattern is involved.

5.2 CONVERTING THEN-YEAR DOLLARS TO BASE-YEAR DOLLARS

To convert then-year dollars to constant dollars:

- Go to the weighted index of the base year that corresponds to the year to which you are converting. Under the proper appropriation column, go to the index number for each of the years you want to convert from then-year dollars.
- Divide the then-year dollar amount for each year, by the index number for that particular year. The result is a dollar amount in each year, expressed in constant dollars of a particular fiscal year.

5.3 CONVERTING BASE-YEAR DOLLARS TO THEN-YEAR DOLLARS

To convert constant dollars to then-year dollars:

- Go to the weighted index with the base year that corresponds to the year from which you are converting. Under the proper appropriation column, go to the index number for each of the years you want to convert into then-year dollars.
- Multiply your constant dollar amount in each year by the index number for that particular year. The result is a dollar amount in each year, expressed in then-year dollars.