



Developing Firm Proposals: *What You Should Know*

Lockheed Martin Tactical Aircraft Systems

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Overview

- ◆ Exploring Parametrics
- ◆ A Few Successes
- ◆ Modeling Firm Proposals with PRICE
- ◆ Areas for Development
- ◆ Lessons Learned

The LMTAS Role

- ◆ Role as a Lab Site (one of thirteen)
 - Develop In-house Cost Estimating Relationships (CERs)
 - Use commercial parametric models in the proposal process
- ◆ Primary Objective
 - Reduce proposal prep span time
 - Improve quality of estimates
 - Optimize the use of resources

LMTAS Status

- ◆ Two In-house developed tools have been validated and approved for use
 - Recurring Tooling CER
 - Nonrecurring Engineering Labor CER
- ◆ Developed and submitted a Firm Proposal using PRICE H, In-house parametric models, and discrete estimates

A Few Successes

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A Few Successes

- ◆ Illuminated major impediments
 - Cost & Pricing data requirements
 - Nonparametric obstacles
 - ◆ DMS
 - ◆ Offset
- ◆ Improved iterative capability
 - Consistency
 - Repeatability
- ◆ Reduced estimate preparation time

A Few Successes

- ◆ Streamlined the Proposal Process
 - Prepared estimate at higher level
 - Eliminated steps in the proposal process
- ◆ Incorporated Simple Innovations
 - Concurrent auditing
 - Open communication
 - IPTs

Modeling Firm Proposals with PRICE

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Implementation Strategy

- ◆ Provided PRICE H training and copies of the off-the-shelf model to all participants
- ◆ Established an IPT to encourage open communication
- ◆ Developed concurrent audit program to evaluate estimate
- ◆ Held *Parametric Applications Workshop*

Calibration

◆ IPT Ground Rules

- Keep it simple
- Mechanical & Electro / Mechanical Boxes only (political, not modeling decision)
- Calibrate model (PRICE H 3.1 in this case) to analogous F-16 program recurring cost - **“Did not pass TINA muster”**

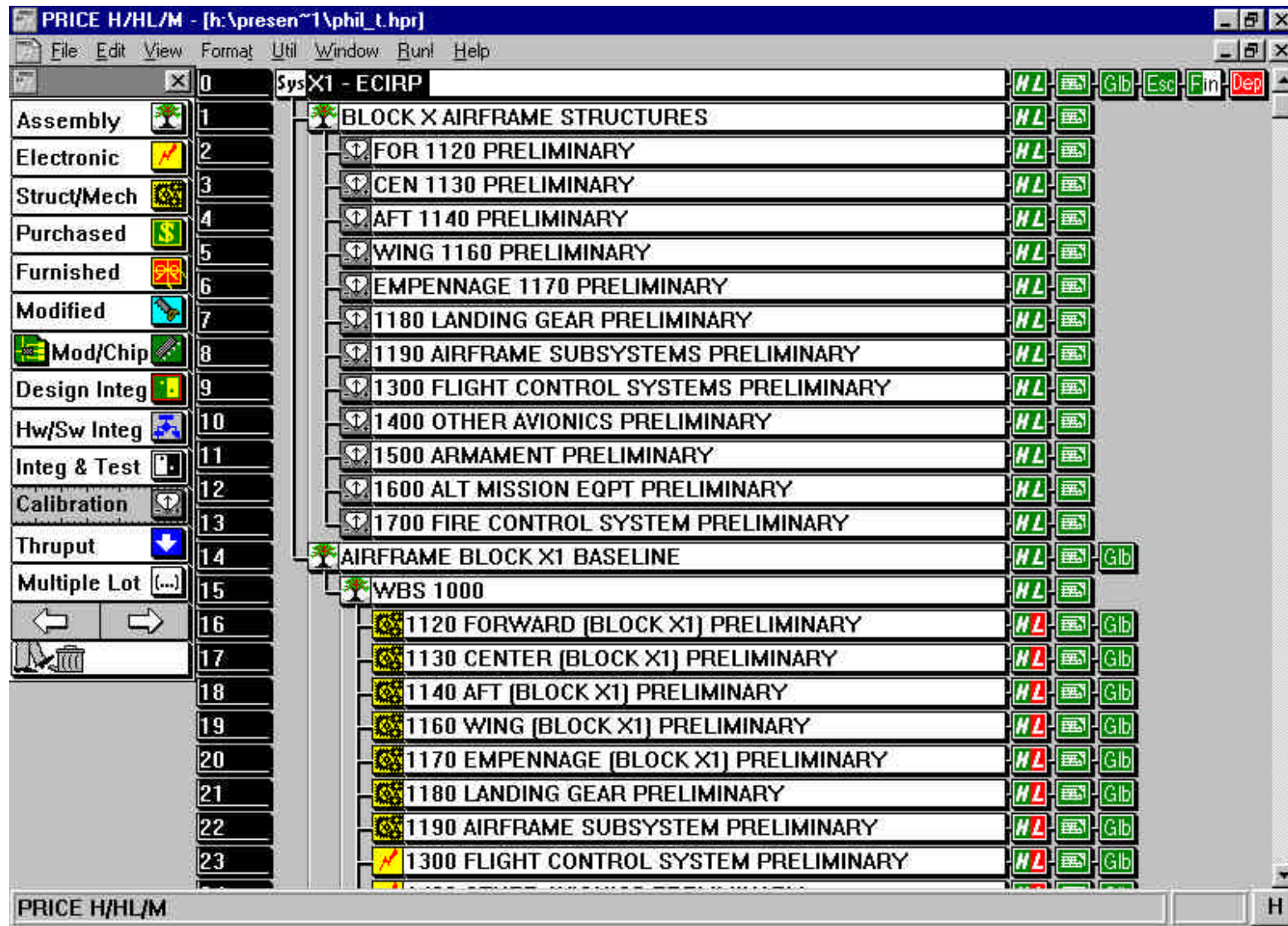
Updated F-16 Calibration... the TINA Compliant Solution

- ◆ Use current standards and realization for labor and current material values based on new quotes
- ◆ Use in house developed models for recurring engineering and logistics
- ◆ This technique works, but the material process eliminates most of the parametric cycle time reduction



Fourth Level WBS Calibration Technique

Basic F-16 Calibration



Calibration Targets

◆ Fourth Level WBS - 1120 Forward Fuselage

DISCRETE VALUES - RECURRING	
FUNCTION	FOURTH LEVEL WBS
	1120
FACTORY FAB	10,000
FACTORY ASSEMBLY	45,000
ELECTRIC BENCH	1,500
FIELD OPERATION	0
PLANT ENGINEERING	0
TOTAL MFG HOURS	56,500
RAW MATERIAL	\$480,000
PURCHASED PARTS	\$1,000,000
STANDARD HARDWARE	\$450,000
OUTSIDE PRODUCTION	\$2,000,000
MISC MATERIAL	\$100
HARDWARE IWTA	\$350,000
TOTAL GENERAL MATERIAL	\$4,280,100
AV/SS	\$250,000
FOREIGN COPROD	\$0
TOTAL MATERIAL	\$4,530,100

Calibration

CALIBRATION [X]

FOR 1120 PRELIMINARY

OK
Cancel

Input Sheet | LM Sheet | ID Sheet

Validate | Notepad | Reset | Help | Override

QTY	PROLOS	WT		VOL	
6	0.000000	1000.000000		15.00000	
QTYNHA	INTEGE	INTEGS		PLTFM	YRTECH
0	0.0000	0.0000		1.800	1997
WS	MCPLXS	NEWST	DESRPS	MBEL	
1000.000000	0.000000	0.000	0.000	0.00	
WECF USEVOL	MCPLXE	NEWEL	DESRPE	EBEL	
0.0000	0.000000	0.000	0.000	0.00	
DSTART	DFPRO	DLPRO	ECMPLX	DTLGTS	PROSUP
0	0	0	0.00000	0.000000	0.00
PSTART	PFAD	PEND	MPI	PTLGTS	RAT00L
797	600	1200	1.00000	0.000000	0.0000000
LAUCOST	LPTCOST	LPRCOST	LDTCOST		LABOR UNITS
0.00	56500.00	0.00	0.00		Hours
COST TYPE		YRBASE			
As Spent		797			

Calibration

CALIBRATION [X]

FOR 1120 PRELIMINARY [OK] [Cancel]

Input Sheet | LM Sheet | ID Sheet

[Validate] [Notepad] [Lock] [Reset] [Help]

	Development		Production	
	Mat'l Index	ODC%	Mat'l Index	ODC%
Draft	0.00	0.00	0.00	0.00
Design	0.00	0.00	0.00	0.00
System	0.00	0.00		
Proj. Mgmt.	0.00	X 13.33	0.00	0.00
Data	X 18.33	0.00	0.00	0.00
Production			65.36	0.00
Prototype	X 0.00	0.00		
Tool Test Eq.	X 60.00	0.00	0.00	0.00
Purchased	100.00	0.00	100.00	0.00

Learning Curve (%)		Aftermarket Supplier (%)	
Material	100.00	0	
Labor	100.00		
B Factor	0.00	100	

Original Equipment Manufacturer (%)

100

Calibration

Basic Estimate				
Cost Summary	LM Totals	LM Production	LM Development	
FOR 1120 PRELIMINARY				
Mon October 19 1998 3:57 PM (Version 4.0)				
Calibration Element:		Costs in (\$1. As Spent)		
Program Cost	Labor Hrs	Labor	Mat'l/ODC	Total
Engineering				
SubTotal(ENG)	0.00	0.00	0.00	0.00
Manufacturing				
Production	56499.77	0.00	4530050.67	4530050.67
Tool Test Eq.	0.00	0.00	0.00	0.00
SubTotal(MFG)	56499.77	0.00	4530050.67	4530050.67
Total Cost	56499.77	0.00	4530050.67	4530050.67
	Schedule Start	First Item	Finish	
LM Production	Jul-97 [36]	Jun-00 [6]	Dec 00 [42]	
	Unit Production Cost	755008.45		
	Monthly Prod Rate	0.83		
Mfg Complexities:	Mechanical			
	7.432642*			
Calculation used Labor Production Total (Hours) 56500.00				

Calibration... Internal & External Customer Comments

- ◆ “Fourth Level is simple and easy to apply for new PRICE H users”
- ◆ “Material precision could be better”
- ◆ “\$50 is great for a R.O.M., but we need to see the real number for calibration / validation in the Basis of Estimate World”

Validation Techniques

- Shadow Pricing
- High level price analysis
- Comparison of estimates (different programs)
- Structure and composition of the estimate elements

Basic Validation Model

PRICE H/HL/M - [h:\progra~1\viper2~1\fy97_4th.hpr]

File Edit View Format Util Window Run! Help

15
16 Assembly
17 Electronic
18 Struct/Mech
19 Purchased
20 Furnished
21 Modified
22 Mod/Chip
23 Design Integ
24 Hw/Sw Integ
25 Integ & Test
26 Calibration
27 Thruput
28 Multiple Lot

WBS 1000

- 1120 FORWARD (BLOCK 50) PRELIMINARY
- 1130 CENTER (BLOCK 50) PRELIMINARY
- 1140 AFT (BLOCK 50) PRELIMINARY
- 1160 WING (BLOCK 50) PRELIMINARY
- 1170 EMPENNAGE (BLOCK 50) PRELIMINARY
- 1180 LANDING GEAR PRELIMINARY
- 1190 AIRFRAME SUBSYSTEM PRELIMINARY
- 1300 FLIGHT CONTROL SYSTEM PRELIMINARY
- 1400 OTHER AVIONICS PRELIMINARY
- 1500 ARMAMENT PRELIMINARY
- 1600 AME PRELIMINARY
- 1700 FIRE CONTROL SYSTEM PRELIMINARY
- 1110 INTEG & ASSY PRELIMINARY

PRICE H/HL/M H

Recommended Model Changes

- ◆ Increase Material Index precision to six decimal places
 - This may seem trivial, but it will help in the audit process
- ◆ Segregate MPI into *MPIL* (labor) and *MPIM* (materials)
 - Our experience shows that labor and material rarely react in the same way to business base changes



Current TINA Compliant F-16 Modeling Approach

The Tool Box Approach

- ◆ LMTAS Labor: PRICE H
- ◆ Subcontracts / Materials: Quotes in PRICE H Purchased Item boxes
- ◆ Recurring Engineering: In house model / estimating database (allocation across all F-16 programs)
- ◆ Logistics: Estimating database (level of effort based)

Current F-16 Model

The screenshot displays a software application window titled "PRICE H/HL/M - [c:\viper2~1\phil_5.hpr]". The interface includes a menu bar (File, Edit, View, Format, Util, Window, Run!, Help) and a toolbar. On the left, a vertical list of categories is shown, numbered 50 to 73. The main area features a hierarchical tree structure of components, each with a small tree icon and a set of icons (HL, G, Gb) to its right. The components are organized into two main sections: 1180 LANDING GEAR and 1190 AIRFRAME SUBSYSTEMS. The 1180 section includes sub-items like 1180 LANDING GEAR MAKE, 1180 BUY, and various material and hardware categories. The 1190 section includes sub-items like MAKE, 1190 MAKE WEIGHT, 1190 BUY, and various engine and fuel cost categories. The bottom status bar shows "PRICE H/HL/M" and a small "H" icon.

Category	Item	Icons
50	1180 LANDING GEAR	HL, G, Gb
51	1180 LANDING GEAR MAKE	HL, G, Gb
52	1180 BUY	HL, G, Gb
53	1180 RAW MATERIAL	HL, G, Gb
54	1180 PURCHASED PARTS	HL, G, Gb
55	1180 STANDARD HARDWARE	HL, G, Gb
56	1180 OUTSIDE PRODUCTION	HL, G, Gb
57	1180 MISC MATERIAL	HL, G, Gb
58	1180 HARDWARE IWTA	HL, G, Gb
59	1180 AVSS	HL, G, Gb
60	1190 AIRFRAME SUBSYSTEMS	HL, G, Gb
61	MAKE	HL, G, Gb
62	1190 MAKE WEIGHT	HL, G, Gb
63	1190 BUY	HL, G, Gb
64	1190 MISC MATERIAL	HL, G, Gb
65	1191 EPU FY97 COST AVSS	HL, G, Gb
66	1192 ELECTRICAL COST AVSS	HL, G, Gb
67	1193 HYDRAULIC AVSS	HL, G, Gb
68	1194 FUEL FY97 COST	HL, G, Gb
69	1194 FUEL COPROD COST	HL, G, Gb
70	1194 FUEL COST AVSS	HL, G, Gb
71	1195 ENGINE COST	HL, G, Gb
72	1195 ENGINE COPROD COST	HL, G, Gb
73	1195 ENGINE COST AVSS	HL, G, Gb

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Key Model Changes

- ◆ Labor and Material are completely segregated by “make / buy” weight splits
 - MPI is used to make business base adjustments to the labor estimate
 - MCPLXS is used to make manufacturing process or material changes
- ◆ Materials are model in purchased item boxes and split into functional categories (this makes the pricing process cleaner)

Areas for Development

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Areas for Development

- ◆ Ensure all participants are involved in the process
- ◆ Use the teaming concept to combat show-stopping obstacles
- ◆ Explore the use of validated databases for pricing future buys
- ◆ Standardize policies & procedures for collecting, evaluating, and data submittals

Common Challenges

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Common Challenges

- ◆ Cultural Bias
- ◆ Distrust of statistics and commercial model
- ◆ The “Look and Feel” of traditional proposals
- ◆ Lack of available resources
- ◆ Regulatory Requirements (FAR, TINA,etc)
 - Currency of In-house and subcontractor data
 - Analysis of subcontractor data

Lessons Learned

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Lessons Learned

- ◆ Establish an IPT
 - Early involvement of team members critical
 - Get the right team members
 - Open communication a must
- ◆ Provide training that develops applied skills
- ◆ Define estimating requirements
- ◆ Determine validation criteria
- ◆ Document your processes & procedures

Lessons Learned

- ◆ A Feel for the “Right Answer”
 - A Program Manager cited, “He was not opposed to the use of parametrics; but, found he was unable to judge the goodness of estimates derived parametrically as the proposal changed during negotiations.” He further cited, “On traditional proposals, he had a feel for whether or not a number, in an estimate, was right or wrong. The same was not true with parametrics.

Lessons Learned

- ◆ Cost & Pricing Data in a Parametric Environment
 - Forecasting ability was one of the initial reasons for choosing parametrics as an estimating approach. Incorporating parametric techniques for forecasting based on solid historical data was the initial idea. What we found is that, although you can forecast costs using historical data, you will ultimately be required to use as your basis of estimate the most current quote or standard.

Lessons Learned

- ◆ Broaden Technical Knowledge in Parametrics
 - Comprehending the idiosyncrasies of the parametric discipline requires broadening the technical knowledge of all participants: particularly the estimating/analyst/auditor functions.
 - Structure policies and procedures to address the needs of the parametric estimators

Lessons Learned

◆ Guidelines Required

- Establish guidelines that resolve latent issues unveiled while implementing the concepts of Parametrics