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81-3

DATE 1/22/81 SUBJECT

Dear Dick: Was nice to have a visit with you yesterday. My congratulations on your achievement of the CVS recognition.

Your paper suggesting cost models of things arranged in a function basis as a guide to selection of the items thingeal depth functional study, is constructive thinking.

Writing your work-book certainly provides a mechanism to motivate depth study of the system. You write exceedingly smoothly.

You will want to correct the items listed under "Miles" Job Plan. I'll list the original of 20 years ago, and the present one in the 2nd edition.

ORIGINAL - (1961 text)

Phase 1 Orientation
" 2 Information
" 3 Speculation
" 4 Analysis
" 5 Program Planning
" 6 Program Execution
" 7 Status Summary and Conclusion.

IMPROVED - (1972 text)

Preliminary - before step 1 Mind Tuning
Exactly what are we trying to do.
Step 1. Information.
Step 2. Analysis
" 3. Creativity
" 4. Judgement
" 5. Developement Planning
(From experience, I learned that the optimum actions after "Development" vary so much, depending upon the situati the person or group involved, the timin and other factors that any one step I might list might be the wrong one.

Best of success to you,
Larry

KWIK-MEMO

Cost modeling useful for complex systems

3.5 DIAGRAM COST MODEL FUNCTIONALLY ~~(Figure 3-1)~~

3.5.1 Philosophy

The technique of cost modeling is particularly useful when dealing with complex systems, such as a complete test station. At this point in time, the team is still in a searching mode.

The search begins at a high level, such as in a feasibility study. At the end of the workshop, very specific changes will be suggested to the decision-makers. To get there, several funneling steps will have taken place. One of the key selling points to the decision-makers is the before and after costs.

Before and after costs are a key selling point

In VE/VA all studies are based on single unit or single system costs. The cost model, as used here, is a pseudo-function cost model of one copy of the "thing" that is the subject of the study. At the end of the completed study, the before and after cost model of the "thing" can be used to sell the changes to an audience that is not necessarily function-oriented.

The original model can also be used as the starting point for the next major step, when we change over from "thing" thinking to pure "function" thinking.

Functional Cost Model and F.A.S.T. diagram differences cited.

3.5.2 Approach (Figure 1)

The approach can easily be implemented by any individual that has not yet been trained in the evolvement of function identification.

The main difference between the "Functional Cost Model" and the F.A.S.T. diagram (which is a major tool in the next phase) is that the Functional Cost Model uses the existing "thing" names within each box. The 'al' at the end of functional infers the pseudo function. The 'al' is dropped after this phase.

If care is taken in the RPI (exact quote request), each "thing" entity should have an alpha task assigned. Alpha subordination should be based on the "guzinta" relationships of each box or "thing", as shown on the official drawings.

Technical perfection, at this stage, is not a must, but the total costs of all the boxes must equal the unit or system "bottom line" as provided by the cost accounting/pricing people. The decision-makers must determine the level at which the bottom line will be depicted. This is the level that will be used for the unit cost comparisons of the before and after model. The current standard at W ILSD is the "operations total" (Total Direct Cost) which does not include G & A, "cost of money", or profit. It does

include overheads associated with labor and material.

Scope will define size of cost model

The physical size of the cost model is dependent on the complexity of the problem as defined by the SCOPE. The cost model size also indicates when you've bitten off more than you can chew. If it is too large and cumbersome, then a feasibility study should be performed first. The result of the feasibility study should be a reduced scope. If the entire system needs to be studied further, additional teams of five can be used to study different areas of the system. "Which" specific area for each team is determined in the "Feasibility Phase" which, as previously stated, is a microminiaturization of a VE/VA workshop.

Subordination of the boxes is left-to-right and top-to-bottom with the highest level in the upper left-hand corner. The basic theme of the system should follow the top row. Other major themes that do not flow into the basic theme are placed in succeeding rows.

For some of the depicted units, costs are shown two ways:

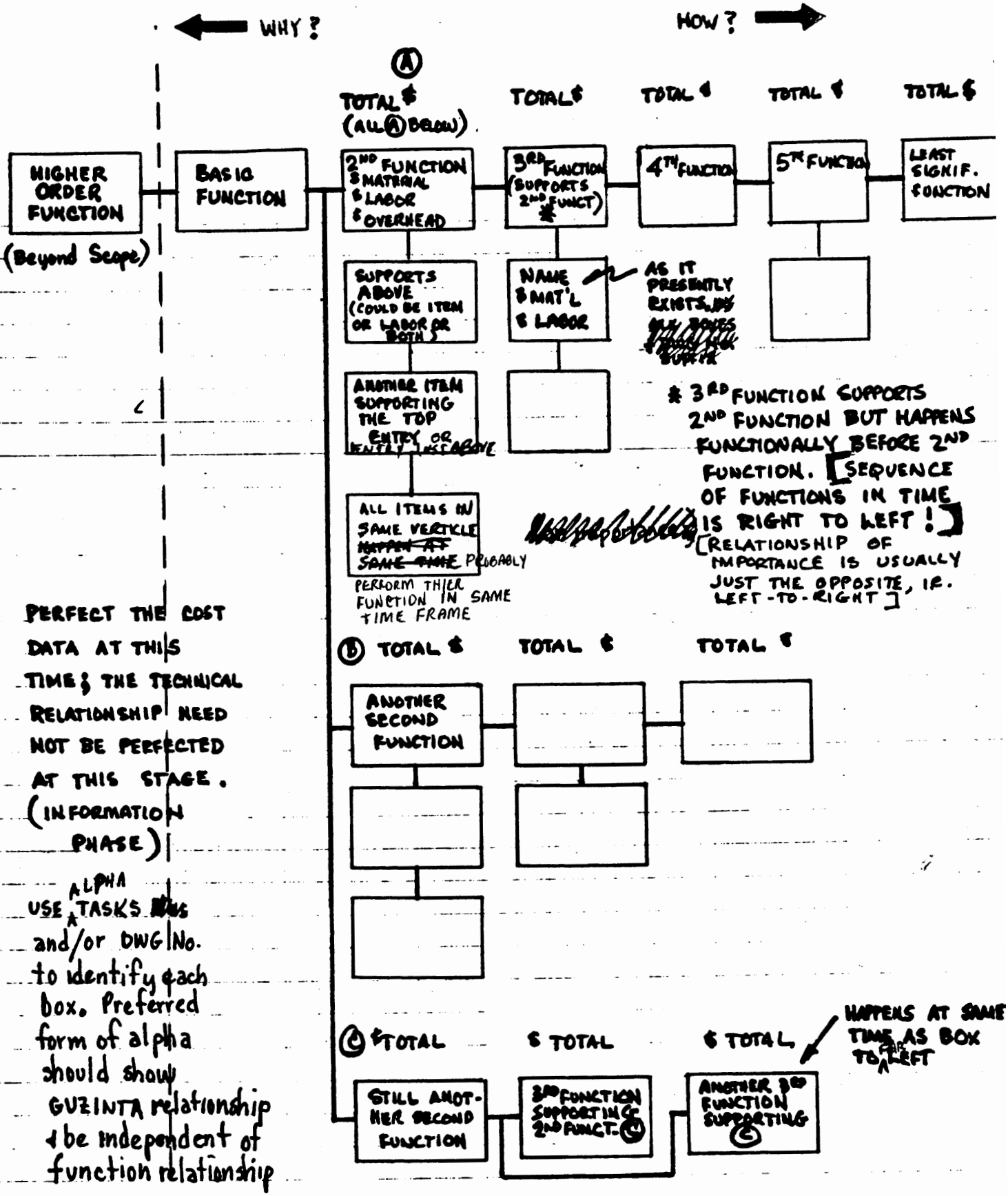
1. The first is the total cost of each unit. The sum of all the boxes should be greater

than the cost of the system because several levels of assembly, subassembly, and sub-subassembly are depicted.

2. For units (boxes) that have subordinate boxes, a simple math exercise should be performed to show the remainder of the cost only. The remainder is what is left after you subtract the subordinate costs. The math test is passed if the delta dollars of all the boxes, when added, equal the system cost.

Each box now has a cost related to the functions or function portions produced by the "thing" depicted.

ART



PERFECT THE COST DATA AT THIS TIME; THE TECHNICAL RELATIONSHIP NEED NOT BE PERFECTED AT THIS STAGE. (INFORMATION PHASE)

USE ALPHA TASKS and/or DWG No. to identify each box. Preferred form of alpha should show GUZINTA relationship & be independent of function relationship

FIGURE 3-1. COST MODEL for _____ (PRESENT WAY - Sheet 1 of)

3.5.3 Example of Cost Model (Figure 3-2)

Large % of total cost devoted to minor functions

In the real example, the total direct or operations cost for each test station is $62,238 for task AAA. Of immediate interest is task BWA, the Probe Module Assembly, Its function is twofold: to support and connect the UUT. The $6029 cost for BWA means that nearly 10% of the total cost is spent to support and connect the unit under test. This is certainly one area where further investigation is merited! The recorder is requested to make note of that.

Typical cost model shown

The sixth horizontal row of figure 3-2 totals $3761 being spent for a major function: "Cool UUT". This function is made up of tasks BKA $401, BXAA $2381, BCB $627, and a portion of BCA equal to $352. The total unit cost for BCA is $6021, but BCA (the Right-Hand Top Plate Assembly) contains subassemblies (BCB and BCC) and sub-subassemblies of BCC, which provide other unrelated functions. (BCC, which contains BCCA and BCCB are shown near the top to the right of center of figure 3-2).

High cost areas are noted.

When all the functions, not related to UUT cooling, are subtracted from BCA, the Δ cost is $352 for an input-air filter and support. The air duct (BCB), connecting the input filter to the blower, costs $627; the blower and related output connections (BXAA) cost $2381; and the plenum box, which "permits connection" to the UUT, costs $401. The total of $3761 just to blow air across the UUT seems unreasonably high and is noted accordingly.

Cost models are beneficial

In "thing" thinking, we think of blowing air across the UUT. In function thinking, we think of COOLing the UUT, which does not constrain us to "blowing air".

There is much more to be observed, discussed, and investigated than shown in this text. The point of the example cost model is to:

a. show how an investigation gets started
b. show the "before" costs in a manner that the decision-makers can readily understand
c. provide a basis for later comparison.

3.5.4 Where Do We Go From Here?

Cost model is visual aid; it bridges gap between cost visibility and function analysis

The cost model points (paragraph 3.5.3) can also be considered as key objectives of the Information Phase. That is, the functional cost model serves as a visual aid to bridge the gap between VE/VA cost visibility/analysis and function analysis, which begins in the next phase.

The functional cost model is used to show the functional relationship of "things" not to show functions per se. You will understand this better after having gone through a real function analysis.

How many readers would think of a "Right-Hand Top Plate Assembly" as being related to the function "Cool UUT"? Thus, whether you are looking at things in the cost analysis or looking at functions, you now have a cross-index means to bridge the gap between the two.

This enables use of the cost model in conjunction with the cost analysis to make a specific list of high-cost:

a. Functional areas

b. Subsystems

c. Assemblies

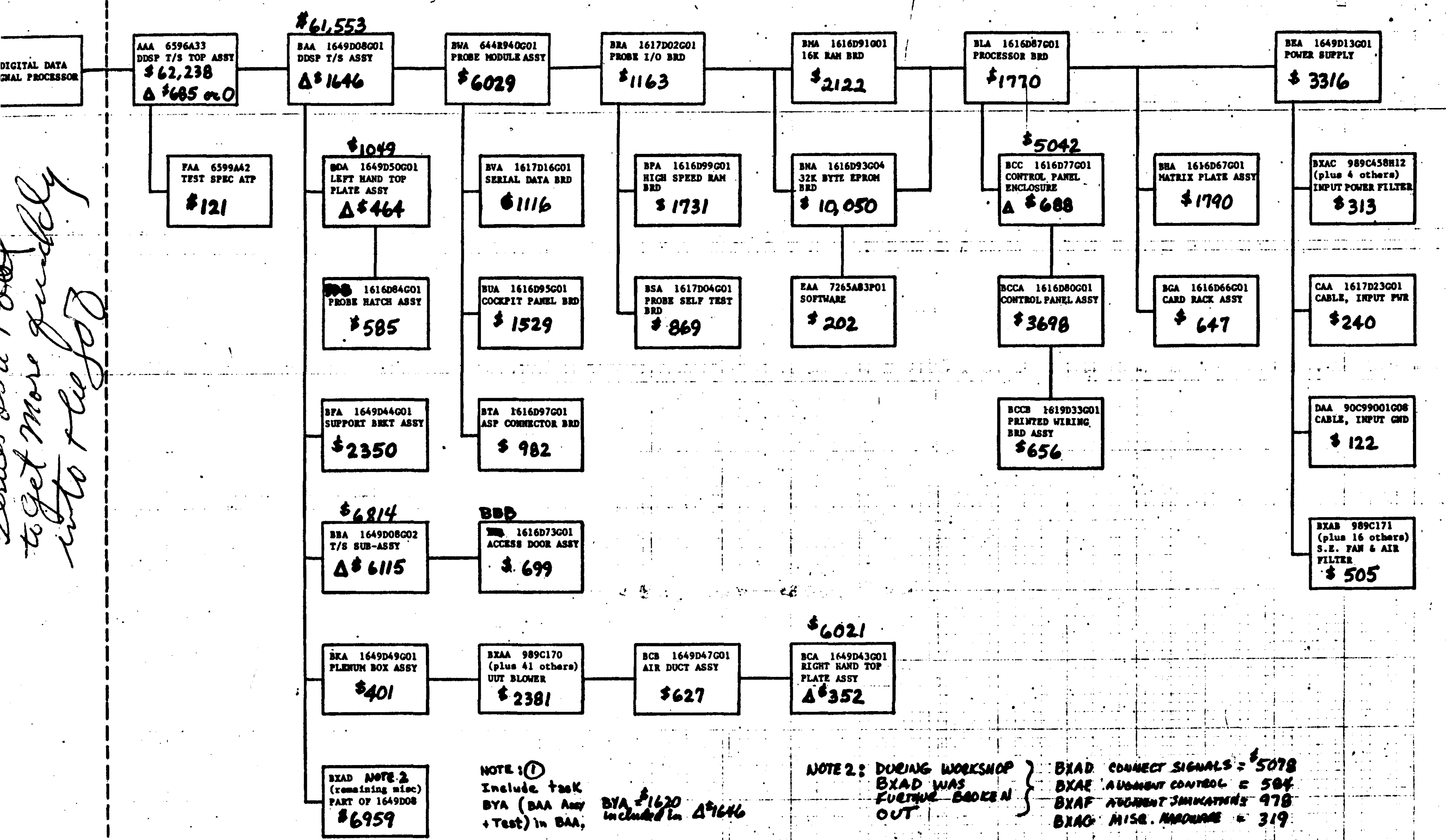
d. Subassemblies

e. Components

Use the list to determine areas where major efforts are warranted

Finally, prioritize the high-cost list to determine areas of the product or service, based on cost proportions, where major efforts are warranted. Focus your attention on them in the next phase. However, don't overlook potential savings on smaller cost items, where it is obvious that relatively smaller efforts will also be fruitful.

Functional Cost model


DIGITAL DATA
SIGNAL PROCESSOR
AAA 6596A33 DDSP T/S TOP ASSY $62,238 Δ $685 or 0
FAA 6599A42 TEST SPEC ATP $121
$61,553
BAA 1649D08G01 DDSP T/S ASSY Δ$1646
$1049
BDA 1649D50G01 LEFT HAND TOP PLATE ASSY Δ$464
1616D84G01 PROBE HATCH ASSY $585
BFA 1649D44G01 SUPPORT BRKT ASSY $2350
$6814
BBA 1649D08G02 T/S SUB-ASSY Δ$6115
BKA 1649D49G01 PLENUM BOX ASSY $401
BXAD NOTE 2 (remaining misc) PART OF 1649D08 $6959
BWA 6448940G01 PROBE MODULE ASSY $6029
BVA 1617D16G01 SERIAL DATA BRD $1116
BUA 1616D95G01 COCKPIT PANEL BRD $1529
BTA 1616D97G01 ASP CONNECTOR BRD $982
BBB
1616D73G01 ACCESS DOOR ASSY $699
BXAA 989C170 (plus 41 others) UUT BLOWER $2381
BRA 1617D02G01 PROBE I/O BRD $1163
BPA 1616D99G01 HIGH SPEED RAM BRD $1731
BSA 1617D04G01 PROBE SELF TEST BRD $869
BCB 1649D47G01 AIR DUCT ASSY $627
BMA 1616D91G01 16K RAM BRD $2122
BNA 1616D93G04 32K BYTE EPROM BRD $10,050
EAA 7265A83P01 SOFTWARE $202
$6021
BCA 1649D43G01 RIGHT HAND TOP PLATE ASSY Δ$352
BLA 1616D87G01 PROCESSOR BRD $1770
$5042
BCC 1616D77G01 CONTROL PANEL ENCLOSURE Δ $688
BCCA 1616D80G01 CONTROL PANEL ASSY $3698
BCCB 1619D33G01 PRINTED WIRING BRD ASSY $656
BHA 1616D67G01 MATRIX PLATE ASSY $1790
BGA 1616D66G01 CARD RACK ASSY $647
BEA 1649D13G01 POWER SUPPLY $3316
BXAC 989C458H12 (plus 4 others) INPUT POWER FILTER $313
CAA 1617D23G01 CABLE, INPUT PWR $240
DAA 90C99001G08 CABLE, INPUT GND $122
BXAB 989C171 (plus 16 others) S.E. FAN & AIR FILTER $505
NOTE 1: Include task BYA (BAA Assy + Test) in BAA,
BYA $1620 included in Δ$1646
NOTE 2: DURING WORKSHOP BXAD WAS FURTHER BROKEN OUT
BXAD CONNECT SIGNALS = $5078
BXAE AUGMENT CONTROL = 584
BXAF AUGMENT INDICATIONS = 978
BXAG MISC. HARDWARE = 319

... to get more quickly into file ...

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