AD-A059 863 ARMY TROOP SUPPORT AND AVIATION MATERIEL READINESS CO--ETC F/G 10/2
HISTORICAL ESCALATION OF OPERATION AND MAINTENANCE COSTS FOR FI--ETC(U)
JUL 78 W H GILLE

UNCLASSIFIED TSARCOM-TR-78-7 NL

1 OF 1

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DATE FILMED 12-78

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SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE

READ INSTRUCTIONS BEFORE COMPLETING FORM

1. REPORT NUMBER	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
Technical Report 78-7		

4. TITLE (and Subtitle)
Historical Escalation of Operation and Maintenance Costs for Field Generator Sets

5. TYPE OF REPORT & PERIOD COVERED
FY75 to FY78 Final Report

6. PERFORMING ORG. REPORT NUMBER

7. AUTHOR(s)
Warren H. Gille, Jr.

8. CONTRACT OR GRANT NUMBER(s)

9. PERFORMING ORGANIZATION NAME AND ADDRESS
US Army Troop Support and Aviation Materiel Readiness Command, 4300 Goodfellow Blvd.
St. Louis, MO 63120 Cost Analysis Division

10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS

11. CONTROLLING OFFICE NAME AND ADDRESS

12. REPORT DATE
July 1978

13. NUMBER OF PAGES
32

14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)

15. SECURITY CLASS. (of this report)
Unclassified

15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

LEVEL II

16. DISTRIBUTION STATEMENT (of this Report)
Approved for Public Release; distribution unlimited.

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

DDC RELEASED SEP 18 1978

18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)
Cost Analysis, Cost Estimates, Cost Tracking, Escalation Factor, Generator, Indexes, Methodology, Models, Operating and Maintenance Cost (OMA), Historical Cost, Prices, Tracking

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)
This report updates the costs developed for Operating and Maintaining Generator Sets established by the Cost Estimating Relationships (CER'S) in TROSCOM Technical Report 74-12. The methodology employed is based on ratio and proportion analysis, wherein each individual component of Operating and Maintenance (O&M) Cost is updated using a specialized index. Then, the cost components are reaggregated into a revised O&M Cost, which more accurately reflects the actual cost than would escalation by a single gross factor. The report covers full load and half load operating costs for most common 60 HZ and 400 HZ Gasoline Engine

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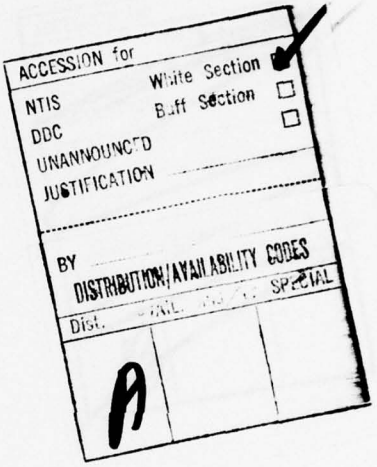
SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

20. Driven (GED) Generator Sets, and also those for common 60 HZ Diesel Engine Driven (DED) Generator Sets. The escalation factor for 400 HZ DED Generator Sets is assumed to be the same as that for corresponding 60 HZ DED Generator Sets, using the previous TROSCOM Tech Report 74-12. The complete statement of methodology is included which allows the analysis to be adapted by the user to fit the specific time period desired. The Generator Sets referenced in this Tech Report are used to support various types of equipment, which means that the cost escalation factors provided should be of value in determining O&M Cost for generators used in a variety of applications.



(14)

USATSARCOM TECHNICAL REPORT 78-7

(9) Final rept. FY75 - FY78,

(6) HISTORICAL ESCALATION OF OPERATION AND MAINTENANCE COSTS FOR FIELD GENERATOR SETS.

(REFERENCE TROSCOM TECHNICAL REPORT 74-12)

(10) WARREN H. GILLE, JR

(11) JULY 1978 (12) 36 P.

U.S. ARMY TROOP SUPPORT
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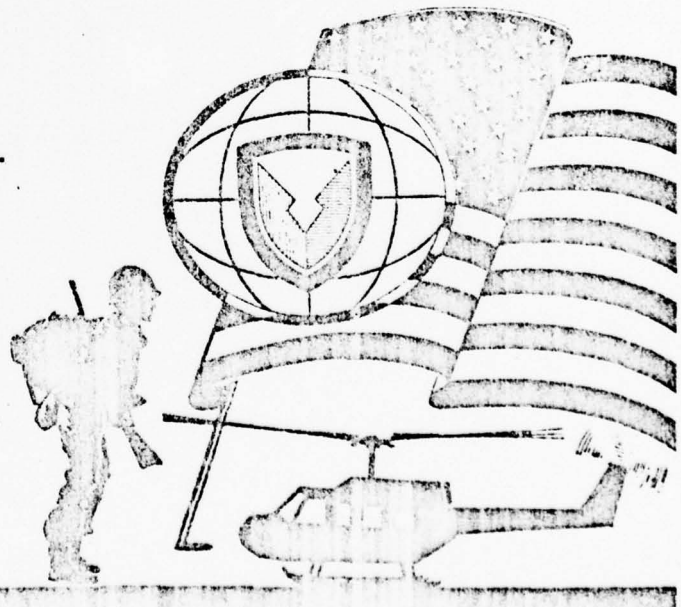

DISCLAIMER STATEMENT

The findings of this report are not to be construed as an official Department of the Army position unless so designated by other authorized documents.

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OPERATING COST INDEX FOR GENERATORS

Inclosed are the essentials for computing Operating Cost Indices for particular gasoline and diesel powered generators. Computation of the appropriate index involves three steps: (The Operating Cost Equation is specified in Part One).

1. Obtain the proper relative weighting factors for the generator of interest in Part Two.

2. Obtain the appropriate values for the relevant cost indices in Part Three.

3. Put values into the Operating Cost Equation and compute the Operating Cost Index.

TSARCOM COMPTROLLER VALIDATION
COST ANALYSIS DIVISION
CECDC REVIEW No. 21/3128-78
VALIDATED
Validation Level: I☐ II☒ III☐
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PART ONE:

OPERATING COST INDEX EQUATION

COMPUTATION OF OPERATING COST INDEX FOR GENERATORS:

OPERATING COST INDEX =

(% OF OPERATING COST ATTRIBUTABLE TO POL) x (POL INDEX) +

(% OF COST ATTRIBUTABLE TO PARTS) x (PARTS INDEX) +

(% OF COST ATTRIBUTABLE TO MAINTENANCE) x (MAINTENANCE INDEX) +

(% OF COST ATTRIBUTABLE TO OVERHAUL) x (OVERHAUL INDEX)

THAT IS, THE OPERATING COST INDEX IS A WEIGHTED SUM OF THE INDEXES FOR THE FOUR COMPONENTS OF OPERATING COST:

1) POL Index
2) Parts Index
3) Maint. Index
4) Overhaul Index

Part Two:

Relative Contribution to Operating Cost: (Relative Weights.)

GASOLINE DRIVEN
RELATIVE WEIGHTING FACTORS FOR OPERATING COST ELEMENTS

	60 HZ					400 HZ		
KW / HR/YR	1.5 / 1000	3 / 1000	5 / 1000	10 / 1000	KW / HR/YR	3 / 1000	5 / 1000	10 / 1000
POL	23.4%	32.1%	36.5%	49.3%		33.9%	36.6%	52.2%
PARTS	25.1%	21.3%	16.1%	12.4%		20.6%	16.4%	11.1%
MAINT	30.4%	25.8%	28.9%	21.5%		24.9%	28.4%	21.6%
OVERHAUL	21.1%	20.8%	18.5%	16.8%		20.6%	18.6%	15.1%
	100%	100%	100%	100%		100%	100%	100%

DIESEL DRIVEN
RELATIVE WEIGHTING FACTORS FOR OPERATING COST ELEMENTS

60 HERTZ DIESEL

KW / HR/YR	5 / 1000	10 / 1000	15 / 1200	30 / 1300	KW / HR/YR	60 / 1500	100 / 2000	150 / 1000	200 / 1000
POL	18.8%	27.1%	25.8%	39.8%		54.6%	61.9%	73.0%	74.8%
PARTS	21.3%	20.2%	23.2%	18.6%		14.2%	11.4%	8.5%	6.6%
MAINT	28.5%	22.6%	15.8%	12.0%		10.5%	7.1%	5.6%	4.4%
OVERHAUL	31.4%	30.1%	35.2%	29.6%		20.7%	19.6%	12.9%	14.2%
	100%	100%	100%	100%		100%	100%	100%	100%

PART THREE:

COST INDEXES FOR OPERATING COST COMPONENTS

COMPUTATION OF INDICES

$$\text{POL Index (Gasoline)} = \frac{\text{(Fuel Cost */gal) Ref. Year}}{\text{(.381 /gal) FY 1975}}$$

$$\text{POL Index (Diesel)} = \frac{\text{(Fuel Cost */gal) Ref. Year}}{\text{(.339 /gal) FY 1975}}$$

* Bulk Prices, as listed in DFSC Bulletin FY 1975: (Bulletin 74-4 dated 25 October 1974)

(1.08 Factor for Oils/Lubricants cancels up on Division)

$$\text{Maintenance Cost Escalation Factor} = \frac{\text{(E4 Yearly Salary) Ref. Year}}{\text{(\$6,875) FY 1975}}$$

(Other factors cancel see Formula p.20 of TROSCOM Tech Report 74-12, January 1975)

OVERHAUL AND PARTS COST INDEXES:

Overhaul cost is a percentage of acquistion cost:

Therefore:

$$\text{Overhaul Cost Index} = \frac{\text{(Elect. Machinery Factor 11-7) FY 1975}}{\text{(Elect. Machinery Factor 11-7) Ref Year}}$$

Also:

$$\text{Parts Cost Index} = \frac{\text{(Electrical Machinery Factor 11-7) FY 1975}}{\text{(Electrical Machinery Factor 11-7) Ref Year}}$$

= See list of factors (11-7) Attached. =

FY 1975 is the basis for the cost figures listed in the referenced report: TROSCOM Tech. Report 74-12, Cost Estimating Relationships for Operating Costs of Mobile Electric Power Generating Sets, January 1975.

Reference Year is the FY to which the original FY75 cost is to be updated.

WHOLESALE PRICE INDICES

The following Wholesale Price Indices should be used for the TROSCOM PEMA items to update prices from past contract prices:

Wholesale Price Index Title	TROSCOM PEMA Item
Rubber and Plastics Products 07	Collapsible Tanks
Heating Equipment 18	Air Conditioners
Fabricated Structural Metal Products 10-7	Heaters
	AVL Bridge (Not including Tank chasis)
	Tanks
	Other Bridges
Machinery and Equipment 11	Power Plant (MUST)
	Firefighting Equipment
	Forklift Trucks
Construction Machinery and Equipment 11-2	Pumps
	Compressors
General Purpose Machinery and Equipment 11-4	Watercraft
Special Industry Machinery and Equipment 11-6	Theodolites
	Tape Equipment
	Surveying Instruments
Electrical Machinery and Equipment 11-7	Generators
	Light Sets
	Utility Elements
Railroad Equipment 14-4	Railroad Equipment
Industrial Commodities	All other items not listed above.

TROOP SUPPORT ITEMS

WHOLESALE PRICE INDICES
HISTORICAL MULTIPLE FACTORS **

FY	(11-6) Special Industrial Mach & Equip	(11-7) Electrical Machinery & Equipment	(14) Transportation Equipment	(14-1) Motor Vehicles & Equip	(14-4) Railroad Equipment
1967	2.021	1.537	-	1.623	2.238
1968	1.937	1.516	-	1.586	2.268
1969	1.847	1.492	-	1.549	2.182
1970	1.758	1.458	1.545	1.514	2.038
1971	1.677	1.404	1.468	1.434	1.948
1972	1.620	1.385	1.411	1.378	1.840
1973	1.577	1.370	1.387	1.359	1.741
1974	1.443	1.315	1.345	1.320	1.611
1975	1.198	1.123	1.173	1.162	1.218
1976/7T	1.082	1.056	1.076	1.072	1.090
1977	1.000	1.000	1.000	1.000	1.000

To move from FY77 to FY78, multiply FY77 cost figure by 1.07. This figure is an estimate based on current Wholesale Price Index data. This estimate will be superceded by fact when the complete data series is available for FY78.

SAMPLE COMPUTATIONS

COMPUTATION OF OPERATING COST INDEX FOR GASOLINE GENERATORS. INDEX: 1975 to 1978

GASOLINE GENERATORS

	60 Hertz				400 Hertz		
	1.5Kw/1000	3Kw/1000	5Kw/1000	10Kw/1000	3Kw/1000	5Kw/1000	10Kw/1000
Half Load Operating Cost/1000 Hours FY 1975			FY 1978 COST SUMMARY				
FY 1978 Cost	1442	1668	2195	2863	1723	2239	2805
Half Load Operating Cost per year FY 1975			FY 1978 COST SUMMARY				
FY 1978 Cost	1442	1668	2195	2863	1723	2239	2805

GASOLINE GENERATORS

	60 Hertz				400 Hertz		
	1.5Kw 1000	3Kw 1000	5Kw 1000	10Kw 1000	3Kw 1000	5Kw 1000	10Kw 1000
Half Load Operating Cost/1000 Hours FY 1975	$1112	$1275	$1659	$2133	$1313	$1692	$2081
Inflation Index X	1.297	1.308	1.323	1.342	1.312	1.323	1.348
FY 1978 Cost	1442	1668	2195	2863	1723	2239	2805

Half Load Operating Cost per year FY 1975	$1112	$1275	$1659	$2133	$1313	$1692	$2081
Inflation Index X	1.297	1.308	1.323	1.342	1.312	1.323	1.348
FY 1978 Cost	1442	1668	2195	2863	1723	2239	2805

GASOLINE GENERATORS

	60 Hertz				400 Hertz		
	1.5Kw/1000	3Kw/1000	5Kw/1000	10Kw/1000	3Kw/1000	5Kw/1000	10Kw/1000
Full Load Operating Cost, $ Per Kw-Hour							
FY 1978 Cost	1.034	.615	.493	.336	.639	.503	.332

FY 1978 COST SUMMARY

Half Load Operating Cost, $ Per Kw-Hour							
FY 1978 Cost	2.062	1.112	.879	.573	1.145	.896	.562

FY 1978 COST SUMMARY

GASOLINE GENERATORS

	60 Hertz				400 Hertz		
	1.5Kw 1000	3Kw 1000	5Kw 1000	10Kw 1000	3Kw 1000	5Kw 1000	10Kw 1000
Full Load Operating Cost, $ Per Kw-Hour	.797	.470	.373	.250	.487	.380	.246
Inflation Index X	1.297	1.308	1.323	1.342	1.312	1.323	1.348
FY 1978 Cost	1.034	.615	.493	.336	.639	.503	.332
Half Load Operating Cost, $ Per Kw-Hour	1.59	.850	.664	.427	.873	.677	.417
Inflation Index X	1.297	1.308	1.323	1.342	1.312	1.323	1.348
FY 1978 Cost	2.062	1.112	.879	.573	1.145	.896	.562

COMPUTATION OF OPERATING COST
INDEX FOR GASOLINE GENERATORS
INDEX: 1975 to 1978

1.5KW	60Hz		Generator		
	Weight		Index		
POL	23.4%	x	1.425	=	.334
Parts	25.1%	x	1.202	=	.302
Maint.	30.4%	x	1.338	=	.407
Overhaul	21.1%	x	1.202	=	.254
	100%				1.297

3KW	60Hz		Generator		
POL	32.1%	x	1.425	=	.457
Parts	21.3%	x	1.202	=	.256
Maint.	25.8%	x	1.338	=	.345
Overhaul	20.8%	x	1.202	=	.250
	100%				1.308

5KW	60Hz		Generator		
POL	36.5%	x	1.425	=	.520
Parts	16.1%	x	1.202	=	.194
Maint.	28.9%	x	1.338	=	.387
Overhaul	18.5%	x	1.202	=	.222
	100%				1.323

COMPUTATION OF OPERATING COST
INDEX FOR GASOLINE GENERATORS
INDEX: 1975 to 1978

10KW	60Hz	Generator			
	Weight		Index		
POL	49.3%	x	1.425	=	.703
Parts	12.4%	x	1.202	=	.149
Maint.	21.5%	x	1.338	=	.288
Overhaul	16.8%	x	1.202	=	.202
	100%				1.342

3KW	400Hz	Generator			
POL	33.9%	x	1.425	=	.483
Parts	20.6%	x	1.202	=	.248
Maint.	24.9%	x	1.338	=	.333
Overhaul	20.6%	x	1.202	=	.248
	100%				1.312

5KW	400Hz	Generator			
POL	36.6%	x	1.425	=	.522
Parts	16.4%	x	1.202	=	.197
Maint.	28.4%	x	1.338	=	.380
Overhaul	18.6%	x	1.202	=	.224
	100%				1.323

COMPUTATION OF OPERATING COST
INDEX FOR GASOLINE GENERATORS
INDEX: 1975 to 1978

10KW	400Hz		Generator		
	Weight		Index		
POL	52.2%	x	1.425	=	.744
Parts	11.1%	x	1.202	=	.133
Maint.	21.6%	x	1.338	=	.289
Overhaul	15.1%	x	1.202	=	.182
	100%				1.348

INDICES FOR FY 75 - FY 78 GENERATOR O&MA INDEX CALCULATION

1. POL Index

✓ a. Gasoline Generator (Bulk: FSN 9130-00-264-6218) = .543/gal / .381/gal

= 1.425

b. Diesel Generator (Bulk: FSN 9140-00-286-5294) = .441/gal / .338/gal

= 1.305

Source DFSC Fuel Supply Bulletin 77-1 verified as accurate with Cameron Station, DFSC Depot, 11 July 1978.

2. Parts Index = $\frac{1.123}{1.000}$ x (1.07)

(1975 to 1977 based on Wholesale Price Index Code 11-7 Electrical Machinery)

1977 to 1978 (OSD Indices 28 Dec 77 O&MA)

= 1.202

3. Maintenance Index = $\frac{E4\ 1978}{E4\ 1975}$

= $\frac{9,199}{6,875}$ = 1.338

4. Overhaul Index = $\frac{(1.123)}{(1.000)}$ x (1.07)

(1975 to 1977 based on Wholesale Price (Now called Producer Price) Index, Dept of Labor, Code 11-7 Electrical Machinery)

OSD Factor (1977 to 1978 28 Dec 77 Indices O&MA)

= 1.202

SAMPLE COMPUTATIONS

COMPUTATION OF OPERATING COST
INDEX FOR DIESEL GENERATORS.
INDEX: 1975 to 1978

60 HERTZ DIESEL

DIESEL GENERATORS

	5Kw 1000	10Kw 1000	15Kw 1200	30Kw 1300	60Kw 1500	100Kw 2000	150Kw 1000	200Kw 1000
Half Load Operating Cost per 1000 Hours FY 1975				FY 1978 COST SUMMARY				
FY 1978 Cost	1398	1740	2456	3072	4278	6147	7551	9747
Half Load Operating Cost per year				FY 1978 COST SUMMARY				
FY 1978 Cost	1398	1740	2935	3993	6417	12293	7551	9747

DIESEL GENERATORS

60 HERTZ DIESEL

	5Kw 1000	10Kw 1000	15Kw 1200	30Kw 1300	60Kw 1500	100Kw 2000	150Kw 1000	200Kw 1000
Half Load Operating Cost per 1000 Hours FY 1975	$1110	$1380	$1965	$2438	$3358	$4817	$5876	$7585
Inflation Index X	1.259	1.261	1.250	1.260	1.274	1.276	1.285	1.285
FY 1978 Cost	1398	1740	2456	3072	4278	6147	7551	9747

Half Load Operating Cost per year	$1110	$1380	$2348	$3169	$5037	$9634	$5876	$7585
Inflation Index X	1.259	1.261	1.250	1.260	1.274	1.276	1.285	1.285
FY 1978 Cost	1398	1740	2935	3993	6417	12293	7551	9747

60 HERTZ DIESEL

DIESEL GENERATORS

	5Kw 1000	10Kw 1000	15Kw 1200	30Kw 1300	60Kw 1500	100Kw 2000	150Kw 1000	200Kw 1000
Full Load Operating Cost, $ Per Kw-Hour			FY 1978 COST SUMMARY					
FY 1978 Cost	.296	.189	.178	.116	.085	.075	.064	.063
Half Load Operating Cost, $ Per Kw-Hour			FY 1978 COST SUMMARY					
FY 1978 Cost	.559	.348	.328	.205	.143	.123	.100	.098

DIESEL GENERATORS

60 HERTZ DIESEL

	5Kw 1000	10Kw 1000	15Kw 1200	30Kw 1300	60Kw 1500	100Kw 2000	150Kw 1000	200Kw 1000
Full Load Operating Cost, $ Per Kw-Hour	.235	.150	.142	.092	.067	.059	.050	.049
Inflation Index X	1.259	1.261	1.250	1.260	1.274	1.276	1.285	1.285
FY 1978 Cost	.296	.189	.178	.116	.085	.075	.064	.063
Half Load Operating Cost, $ Per Kw-Hour	.444	.276	.262	.163	.112	.096	.078	.076
Inflation Index X	1.259	1.261	1.250	1.260	1.274	1.276	1.285	1.285
FY 1978 Cost	.559	.348	.328	.205	.143	.123	.100	.098

COMPUTATION OF OPERATING COST INDEX FOR DIESEL GENERATORS
INDEX: 1975 to 1978

5KW	Diesel Weight		Generator Index		
POL	18.8%	x	1.305	=	.245
Parts	21.3%	x	1.202	=	.256
Maint.	28.5%	x	1.338	=	.381
Overhaul	31.4%	x	1.202	=	.377
	100%				1.259

10KW	Diesel		Generator		
POL	27.1%	x	1.305	=	.354
Parts	20.2%	x	1.202	=	.243
Maint.	22.6%	x	1.338	=	.302
Overhaul	30.1%	x	1.202	=	.362
	100%				1.261

15KW	Diesel		Generator		
POL	25.8%	x	1.305	=	.337
Parts	23.2%	x	1.202	=	.279
Maint.	15.8%	x	1.338	=	.211
Overhaul	35.2%	x	1.202	=	.423
	100%				1.250

COMPUTATION OF OPERATING COST INDEX FOR DIESEL GENERATORS
INDEX: 1975 to 1978

30KW	Diesel Weight		Generator Index		
POL	39.8%	x	1.305	=	.519
Parts	18.6%	x	1.202	=	.224
Maint.	12.0%	x	1.338	=	.161
Overhaul	29.6%	x	1.202	=	.356
	100%				1.260

60KW	Diesel		Generator		
POL	54.6%	x	1.305	=	.713
Parts	14.2%	x	1.202	=	.171
Maint.	10.5%	x	1.338	=	.141
Overhaul	20.7%	x	1.202	=	.249
	100%				1.274

100KW	Diesel		Generator		
POL	61.9%	x	1.305	=	.808
Parts	11.4%	x	1.202	=	.137
Maint.	7.1%	x	1.338	=	.095
Overhaul	19.6%	x	1.202	=	.236
	100%				1.276

COMPUTATION OF OPERATING COST INDEX FOR DIESEL GENERATORS
INDEX: 1975 to 1978

150KW	Diesel Weight		Generator Index		
POL	73.0%	x	1.305	=	.953
Parts	8.5%	x	1.202	=	.102
Maint.	5.6%	x	1.338	=	.075
Overhaul	12.9%	x	1.202	=	.155
	100.0%				1.285

200KW	Diesel		Generator		
POL	74.8%	x	1.305	=	.976
Parts	6.6%	x	1.202	=	.079
Maint.	4.4%	x	1.338	=	.059
Overhaul	14.2%	x	1.202	=	.171
	100.0%				1.285

INDICES FOR FY 75 - FY 78 GENERATOR O&MA INDEX CALCULATION

1. POL Index

a. Gasoline Generator (Bulk: FSN 9130-00-264-6218) = .543/gal / .381/gal

= 1.425

b. Diesel Generator (Bulk: FSN 9140-00-286-5294) = .441/gal / .338/gal

= 1.305

Source DFSC Fuel Supply Bulletin 77-1 verified as accurate with Cameron Station, DFSC Depot, 11 July 1978.

2. Parts Index = $\frac{1.123}{1.000}$ x (1.07)

(1975 to 1977 based on Wholesale Price Index Code 11-7 Electrical Machinery)

1977 to 1978 (OSD Indices 28 Dec 77 O&MA)

= 1.202

3. Maintenance Index = $\frac{E4\ 1978}{E4\ 1975}$

= $\frac{9,199}{6,875}$ = 1.338

4. Overhaul Index = $\frac{(1.123)}{(1.000)}$ x (1.07)

(1975 to 1977 based on Wholesale Price (Now called Producer Price) Index, Dept of Labor , Code 11-7 Electrical Machinery)

OSD Factor (1977 to 1978 28 Dec 77 Indices O&MA)

= 1.202

APPENDIX A

CALCULATION OF WEIGHTING FACTORS

(PERCENT OF COST ATTRIBUTABLE TO A COST ITEM, SUCH AS POL)

EXAMPLE: GASOLINE GENERATOR

1.5 KW 1000 HOUR YEAR

(REFERENCE COL. 1, P. 17, TROSCOM TECH REPORT 74-12)

POL, AS A PERCENTAGE OF ACQUISITION COST (FUEL, OIL, AND LUBRICANT COST)	16.7%
PARTS, AS A PERCENTAGE OF ACQUISITION COST	17.9%
MAINTENANCE, AS A PERCENTAGE OF ACQUISITION COST	21.7%
OVERHAUL COST, AS A PERCENTAGE OF ACQUISITION COST	15.0%
	71.3%

BECAUSE ORIGINAL ACQUISITION COST IS FIXED (A CONSTANT),
CALCULATION OF PERCENTAGE CONTRIBUTION TO COST (WEIGHTS)
IS A SIMPLE RATIO AND PROPORTION PROBLEM:

PERCENT CONTRIBUTION OF POL	=	(16.7)/(71.3)	= 23.4 %
PERCENT CONTRIBUTION OF PARTS	=	(17.9)/(71.3)	= 25.1 %
PERCENT CONTRIBUTION OF MAINT.	=	(21.7)/(71.3)	= 30.4 %
PERCENT CONTRIBUTION OF OVRHL.	=	(15.0)/(71.3)	= 21.1 %
			100.0 %

THESE FACTORS, AND THE OTHER WEIGHTING FACTORS, ARE DISPLAYED IN THE TABLES ON PAGE (5) .