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OVERHAUL/REBUILD COST STUDY -
WECOM ITEMS

Patrick J. Gannon, et al

Army Weapons Command
Rock Island, Illinois

November 1972

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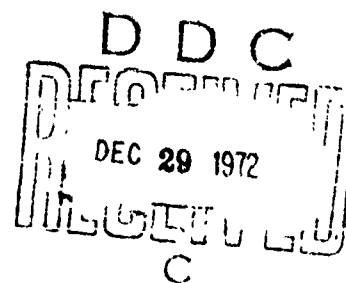
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TECHNICAL REPORT

Patrick J. Gannon
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NOVEMBER 1972

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OVERHAUL/REBUILD COST STUDY

WECOM ITEMS

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HEADQUARTERS, US ARMY WEAPONS COMMAND
COST ANALYSIS DIVISION
(AMSWE-CPE)
ROCK ISLAND, ILLINOIS

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III

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INTRODUCTION

This study was performed by the Cost Analysis Division, Headquarters, U.S. Army Weapons Command and was written to be useful for personnel knowledgeable in depot maintenance activities but also comprehensive to personnel not normally associated with depot maintenance. It covers the major end items for which WECOM has management responsibility plus a few items recently transferred to TACOM and represents a revised update of previous efforts in the depot overhaul area. The original study was done in November 1968 and an update of the original study was completed in July 1970. This study has as its primary purpose the further development and refinement of overhaul cost estimating methodology with a secondary purpose to develop a rebuild/overhaul cost data base on major items currently in the Army inventory.

Actual rebuild/overhaul costs were made available through annual Program Status Reports (PSR's) obtained from the Army Major Item Data Agency. Consideration has been given to periodic changes in fiscal codes as presented in AR 37-100-XX over the time frame for which data were collected. Data in this study are predicated only upon WAC Code A1 which is Depot Cyclic/Normal Overhaul/Rebuild defined in Appendix A.

SCOPE OF STUDY

The purpose of this study is to provide a sound basis for estimating overhaul/rebuild costs for WECOM items. Historical CONUS and OCONUS depot overhaul/rebuild depot cost data on each major item are summarized. Also, cost estimating relationships (CER's) are provided with which the CONUS depot overhaul/rebuild cost of items not previously overhauled can be estimated.

OVERHAUL COST ESTIMATING PROCEDURES

I. Major Items Previously Overhauled.

The following equation is to be used to estimate the unit total cost of overhaul in FY 73 dollars for a major item listed in Section II.

$$\text{ESTIMATE UNIT OVERHAUL COST} = \text{MH} \cdot (\text{TOTAL HOURLY RATE}) + \text{FP} + \text{UP}$$

Where MH: manhours based on manhour experience provided in Section II.

TOTAL HOURLY RATE: sum of the direct, indirect and G&A rates in FY 73 dollars displayed by depot and major item group in Section I.

FP: funded parts cost based on the historical weighted average funded parts cost in FY 73 dollars presented in Section II.

UP: unfunded parts cost based on the historical weighted average unfunded parts cost in FY 73 dollars presented in Section II.

EXAMPLE:

M105 Articulated Telescope FSN 1240-764-1667

It is assumed:

1. Manhours to overhaul will equal the historical weighted average of past experience presented in Section II.
2. Overhaul will take place at Letterkenny Depot.
3. Funded parts cost will be 25% less than the historical weighted average funded parts cost presented in Section II.
4. No unfunded parts cost.

$$\begin{aligned}\text{UNIT OVERHAUL COST} &= (18.34) \cdot (11.95) + (.75) \cdot (54.91) + 0 \\ &= 219.16 + 41.18 \\ &= \$260.34\end{aligned}$$

Manhour and parts cost data presented in Section II can be adjusted based on facts known by the estimator. For example, a lot of items requiring overhaul may be in such extremely poor condition that the parts cost presented in Section II is insufficient. Also three point overhaul/rebuild estimates can be generated by varying data in Section I and/or Section II.

II. Major Items Not Previously Overhauled.

To estimate the CONUS unit funded cost of overhaul in FY 73 dollars for a major item not listed in Section II, a cost estimating relationship (CER) from Section III may be utilized. After selecting the appropriate CER the CONUS funded unit overhaul cost is estimated by substituting into the CER the required independent variable value.

Example:

Straight telescope with a standard price of \$110.

$$\begin{aligned}\text{ESTIMATED CONUS UNIT FUNDED OVERHAUL COST} &= 36.698 + 0.289 \cdot (110) \\ &= \$68.49\end{aligned}$$

SECTION I

DEPOT OVERHAUL/REBUILD LABOR RATES

The chart on the following page represents the reported FY 73 labor rates of the CONUS and OCONUS depots. The rates have been varying due to economic conditions and also due to the labor grade mix required to complete the varying conditions of each overhaul workload.

FY 73 DEPOT LABOR AND INDIRECT CHARGES PER HOUR

	TOWED ARTILLERY				TRACKED COMBAT VEHICLES				FIRE CONTROL			
	Dir Lab	Ind Lab	G&A	Total	Dir Lab	Ind Lab	G&A	Total	Dir Lab	Ind Lab	G&A	Total
<u>CONUS DEPOTS</u>												
Anniston	6.19	4.46	1.27	11.92	6.20	4.35	1.27	11.82	6.46	4.54	1.27	12.27
Letterkeny	5.95	5.05	1.15	12.15	5.95	5.05	1.15	12.15	6.15	4.65	1.15	11.95
Pueblo	6.13	4.46	1.78	12.37	6.13	4.46	1.78	12.37	6.61	4.46	1.78	12.85*
Red River	6.06	4.68	1.35	12.09	6.06	4.68	1.35	12.09	6.28	4.66	1.35	12.29
Tooele	6.42	4.09	1.15	11.66	6.43	4.26	1.15	11.84	6.41	3.98	1.15	11.54
Composite	6.15	4.55	1.34	12.04	6.15	4.56	1.34	12.05	6.38	4.46	1.34	12.18
<u>CONUS MFG ARSENALS</u>												
Rock Island	7.60	7.83	4.95	20.38	7.94	8.18	5.16	21.28	6.97	7.18	4.53	18.68
Watervliet												
<u>OCONUS Depots</u>												
Daimler Benz												
Luther Werke												
Sagami												

*These rates may be used for Aircraft Armament Subsystems.

FY 73 DEPOT LABOR AND INDIRECT CHARGES PER HOUR

TRACKED COMBAT VEHICLES				FIRE CONTROL				SMALL ARMS				COMPOSITE			
Dir Lab	Ind Lab	G&A	Total	Dir Lab	Ind Lab	G&A	Total	Dir Lab	Ind Lab	G&A	Total	Dir Lab	Ind Lab	G&A	Total
6.20	4.35	1.27	11.82	6.46	4.54	1.27	12.27	6.19	4.46	1.27	11.92*	6.20	4.35	1.27	11.82
5.95	5.05	1.15	12.15	6.15	4.65	1.15	11.95	6.15	4.65	1.15	11.95	6.26	4.73	1.15	12.14
6.13	4.46	1.78	12.37	6.61	4.46	1.78	12.85*	6.13	4.46	1.78	12.37	6.39	4.46	1.78	12.63
6.06	4.68	1.35	12.09	6.28	4.66	1.35	12.29	6.28	4.66	1.35	12.29*	6.06	4.68	1.35	12.09
6.43	4.26	1.15	11.84	6.41	3.98	1.15	11.54	6.41	3.98	1.15	11.54	6.61	4.22	1.15	11.98
6.15	4.56	1.34	12.05	6.38	4.46	1.34	12.18	6.23	4.44	1.34	12.01	6.30	4.49	1.26	12.13
7.94	8.18	5.16	21.28	6.97	7.18	4.53	18.68	8.04	10.13	5.23	23.40	7.82	8.05	5.08	20.95
												7.13	8.57	4.45	20.15
															9.24
												4.47	1.64	3.16	9.27
												5.48	.80		6.28

Subsystems.

SECTION II

MAJOR ITEM OVERHAUL DATA

This section provides the following overhaul/rebuild data by major item:

1. Historical (FY 66 - 72) weighted average 1/ funded parts 2/ cost in FY 73 dollars.
2. Historical (FY 66 - 72) weighted average unfunded parts 2/ cost in FY 73 dollars
3. Historical weighted average manhours.
4. Manhour experience range based on:
 - a. High weighted average manhour year.
 - b. Low weighted average manhour year.

The probable causes for variance in manhour experience are such factors as initial condition of item, quantity overhauled, etc. Data for major items are presented in FSN numerical sequence for both CONUS and OCONUS depot overhaul.

1/ The difference between weighted average and average is that the former puts greater emphasis on yearly quantities than does the latter.

2/ Definitions of funded and unfunded parts are presented in Appendix A.

1. CONUS Depot Overhaul

FSN	Nomenclature	Unit Weighted Average		Manhour Experience Range	
		Funded Parts (73\$)	Unfunded Parts (73\$)	High	Low
1005-072-5011	M14A1 Rifle 7.62 mm	68.46	17.25	3.05	1.75
1005-073-9421	M16A1 Rifle 5.56 mm	26.12	5.67	3.19	3.19
1005-214-0934	S&W Revolver Cal .38	1.63		2.32	1.61
1005-317-2425	M36 Gun Mount	59.28		14.41	12.11
1005-317-2427	M36A1 Gun Mount	57.71		13.08	11.51
1005-317-2428	M36A2 Gun Mount	30.81		19.88	15.75
1005-317-2442	M31C Pedestal Mount	44.83		6.00	5.38
1005-322-9715	M2 Machine Gun Cal .50 HB	56.54	3.93	7.67	7.19
1005-322-9716	M3 Tripod Mount	31.04		6.28	4.37
1005-322-9718	M2 Tripod Mount	16.53		3.89	3.40
1005-322-9727	M24A3 Gun Mount	21.88		4.00	4.00
1005-511-9042	M8C Spotting Rifle Cal .50	181.61	3.86	5.95	3.36
1005-589-1271	M14 Rifle 7.62 mm	15.03	2.97	1.84	1.34
1005-602-2105	M2 Machine Gun Cal .50 HB	73.51		8.07	7.86
1005-605-7710	M60 Machine Gun 7.62 mm	74.80	16.18	6.42	5.67
1005-606-8412	M2 Machine Gun Cal .50	22.50		11.00	4.86
1005-670-7670	M1 Carbine Cal .30	2.90	.70	1.33	.50

FSN	Nomenclature	Unit Weighted Average		Manhour Experience Range	
		Funded	Unfunded	High	Low
		Parts (73\$)	Parts (73\$)	Manhours	
1005-670-7675	M2 Carbine Cal .30	20.46	.92	1.55	1.70 1.25
1005-672-1643	M1919A4 Machine Gun Cal .30	84.76	1.82	5.26	5.34 5.26
1005-672-1649	M1919A6 Machine Gun Cal .30	78.68	2.82	6.31	6.82 5.55
1005-672-1771	M3A1 Submachine Gun Cal .45	5.32		1.71	1.73 1.64
1005-673-4750	M55 Machine Gun Mount	735.74	339.40	230.90	266.58 205.38
1005-673-7965	M1911A1 Pistol Cal .45	6.35	.86	1.53	1.88 1.28
1005-674-1309	M1918A2 Rifle Cal .30	86.61	1.87	4.46	7.47 3.70
1005-674-1425	M1 Rifle Cal .30	18.10	1.15	1.46	1.71 1.43
1005-67-1431	USM1D Sniper's Rifle Cal .30	53.93	4.50	3.93	3.97 3.63
1005-678-9828	M14NM Rifle 7.62 mm	90.29		4.22	9.12 3.11
1005-690-2790	M85 Machine Gun	339.66	100.75	9.99	10.01 7.50
1005-693-4854	M2 Machine Gun Cal .50	79.63	18.36	9.11	10.03 6.86
1005-704-6650	Machine Gun Mount	2.45		4.90	5.06 3.91
1005-710-5599	M122 Tripod Mount	23.25		4.20	4.37 3.19
1005-711-5031	M49 Ring Mount	7.69		9.08	10.53 9.06
1005-716-2946	M37 Machine Gun Cal .30	32.42		7.00	7.00 7.00
1005-726-5636	M2 Machine Gun Cal .50 HB	45.64	42.85	8.44	8.44 8.44

FSN	Nomenclature	Unit Weighted Average			Manhour Experience Range	
		Funded Parts (73\$)	Unfunded		High	Low
			Parts (73\$)	Manhours		
1005-726-5687	Revolver Cal .38	1.03	4.39	2.12	2.20	1.81
1005-726-5786	Revolver Cal .38	1.95		1.78	2.20	1.73
1005-736-4875	AA Mount Machine Gun	89.64		11.54	13.64	10.04
1005-834-6119	AA Mount Machine Gun	118.35		8.86	9.11	6.00
1005-836-7286	Machine Gun Mount	10.92		8.86	9.45	8.42
1005-840-3758	M13 Rifle Cal .22	9.94	.08	2.04	2.11	1.98
1005-854-4463	M142 Mount Machine Gun	2.99		5.34	6.62	4.10
1005-869-8816	M73 Machine Gun 7.62 mm	216.78	32.43	12.19	13.82	10.76
1005-890-2610	M66 Ring Mount	30.10		20.75	20.75	20.75
1005-953-9073	M2 Armament Subsystem	551.66	140.35	25.27	25.27	25.27
1005-957-3893	M2 Machine Gun Cal .50	49.08	10.39	6.25	6.25	6.25
1005-973-0375	M60C Machine Gun 7.62 mm	74.67	49.78	4.64	6.17	4.10
1005-999-8194	M27 Armament Subsystem	5498.00		36.55	36.55	36.55

FSN	Nomenclature	Unit Weighted Average			Manhour Experience Range	
		Funded Parts (73\$)	Unfunded Parts (73\$)	Manhours	High	Low
1010-322-9737	M18 Recoilless Rifle 57 mm	57.56	27.10	18.90	18.98	18.54
1010-322-9739	M18A1 Recoilless Rifle 57 mm	19.50	28.02	19.00	19.32	18.70
1010-673-2006	M2 Mortar 60 mm	36.02		12.73	13.13	12.18
1010-673-2010	M19 Mortar 60 mm	21.36		10.17	13.30	10.02
1010-691-1382	M79 Grenade Launcher	30.74		4.70	4.70	4.70
1015-073-5367	M37 Recoil Mechanism	730.90	.96	90.55	94.29	88.71
1015-086-8164	M102 Howitzer 105 mm	3265.00		184.45	184.45	184.45
1015-099-8248	M2A5 Recoil Mechanism	347.72	.17	96.23	108.22	70.83
1015-099-8249	M2A4 Recoil Mechanism	383.39	.84	92.79	140.66	71.29
1015-133-8484	M40A2 Recoilless Rifle 106 mm	316.35		47.53	47.53	47.53
1015-322-9720	M30 Mortar 107 mm	185.69		26.35	33.21	22.77
1015-322-9752	M101A1 Howitzer 105 mm	1483.00	1079.00	252.26	280.67	185.57
1015-348-4923	M40A1 Recoilless Rifle	185.87	77.66	47.19	51.36	38.38
1015-505-5285	Equilibrator	307.01		359.54	554.54	100.34
1015-511-9124	M40 Recoilless Rifle Mount	236.55		28.20	28.25	28.00
1015-657-7534	M67 Recoilless Rifle 90 mm	25.19		18.24	18.53	18.21
1015-691-1289	M20 Recoilless Rifle 75 mm	126.73	82.14	14.86	20.02	13.82

FSN	Nomenclature	Unit Weighted Average			Manhour Experience Range	
		Funded	Unfunded	Manhours	High	Low
		Parts (73\$)	Parts (73\$)			
1015-714-1822	M1A6 Recoil Mechanism	146.66		71.74	71.74	71.74
1015-736-3974	M87 Gun Mount	183.10		35.33	35.33	35.33
1015-840-1836	M29 Mortar 81 mm	228.49	8.99	20.73	29.69	17.94
1025-050-8922	Equilibrator	386.60		37.87	44.11	32.45
1025-322-9755	M114 Howitzer 155 mm	2296.00	1784.00	284.89	364.86	238.95
1025-322-9768	M114A1 Howitzer 155 mm	4890.00	2176.00	282.00	335.77	225.59
1025-653-7593	Equilibrator	84.50		6.27	7.50	5.61
1025-713-3221	Equilibrator	73.87		40.12	40.36	28.00
1025-714-8074	M6A2 Recoil Mechanism	670.63	10.17	173.65	192.53	172.33
1025-863-5613	M158 Mount Assembly	2734.00		193.59	201.71	136.46
1025-994-8931	M123A1 Howitzer 155 mm	3595.00		226.83	247.49	199.97
1030-322-9788	M115 Howitzer 8 in	3938.00	2378.00	454.15	511.67	395.86
1030-714-1826	M4A1 Recoil Mechanism	1018.00		145.46	145.46	145.46
1055-840-1842	M20A1B1 Rocket Launcher 3.5 in	69.92	.02	6.61	6.81	5.04
1090-933-6701	M28 Armament Subsystem	11317.00	10897.00	430.97	230.97	230.97

FSN	Nomenclature	Unit Weighted Average			Manhour Experience Range	
		Funded Parts (73\$)	Unfunded Parts (73\$)		High	Low
			Parts (73\$)	Manhours		
1220-344-4678	M13 Ballistic Computer	58.51	1.23	36.14	37.08	32.11
1220-448-0131	M18 Gun Computer	1013.00	3315.00	481.45	522.10	410.00
1220-546-9735	M13A1 Ballistic Computer	37.70	1.11	29.35	34.63	27.40
1220-572-8738	M16 Computer	293.70		40.00	40.00	40.00
1220-676-2182	M13A1D Ballistic Computer	149.79	.30	32.37	48.64	24.96
1220-766-5137	M38 Sight Computer	121.05	18.71	36.23	46.03	32.75
1220-766-5139	Computer Assembly	38.06	1.58	31.57	47.56	23.86
1220-774-9445	M13A1C Ballistic Computer	33.41	4.85	50.22	33.25	27.42
1220-856-9454	M13A2 Ballistic Computer	58.14	.64	31.42	35.80	27.36
1220-870-6274	M13B1C Ballistic Computer	61.27	2.04	28.82	36.85	24.66

FSN	Nomenclature	Unit Weighted Average			Manhour Experience Range	
		Funded Parts (73\$)	Unfunded Parts (73\$)	Manhours	High	Low
1240-056-4854	Infinity Sight	9.00		8.66	9.06	6.81
1240-076-0066	M113 Panoramic Telescope	268.60		39.68	106.00	26.00
1240-300-6601	M101 Telescope	105.02		28.91	32.73	25.48
1240-300-7989	M34A2 Sight Unit	37.02		13.10	15.86	10.64
1240-344-4632	M12A7K Panoramic Telescope	77.05		14.05	16.76	10.33
1240-344-4633	M12A7H Panoramic Telescope	27.03	.19	13.72	14.75	10.79
1240-344-4644	M23 Periscope	10.32		5.27	6.00	4.92
1240-344-4645	M20A1 Periscope	68.78	58.22	9.90	11.86	8.74
1240-344-4646	M97C Telescope	13.85		12.33	15.14	8.64
1240-344-4654	M13 Range Finder	187.63		68.84	72.66	64.75
1240-344-4668	M100 Panoramic Telescope	131.45	.07	37.46	43.85	31.95
1240-344-4672	M93 Telescope	92.66		27.78	29.34	24.39
1240-344-4674	M95C Telescope	89.51		37.00	39.07	34.77
1240-346-8735	M28 Sight Periscope	26.77		10.21	10.36	9.84
1240-360-1593	M97 Telescope	36.24	.72	12.81	15.00	11.45
1240-546-6339	M92D Telescope	10.12		4.87	5.68	3.60
1240-546-9580	M20A3 Periscope	63.18	30.88	10.65	11.63	8.56

FSN	Nomenclature	Unit Weighted Average			Manhour Experience Range	
		Funded Parts (73\$)	Unfunded Parts (73\$)	Manhours	High	Low
1240-601-4065	M90F Telescope	39.80		5.47	5.47	5.00
1240-608-2062	M13A1 Range Finder	450.63	19.17	73.65	73.91	64.35
1240-554-3811	M15 Tripod Mount	.87		2.12	2.12	2.12
1240-657-4387	M17 Tripod Mount	9.50		5.93	7.02	5.59
1240-676-2173	M17C Range Finder	277.10	.43	88.83	102.80	82.80
1240-676-2174	M31 Periscope	79.11	.51	20.15	21.29	16.83
1240-676-2178	M105C Telescope	122.58		24.93	25.00	24.00
1240-676-2181	M44C Sight, Infinity	5.29		4.75	5.20	4.00
1240-706-0794	M28C Sight, Periscope	35.34		10.30	10.84	9.99
1240-716-2947	Sight Reflecting	10.33		1.44	2.50	.84
1240-732-1469	M97H Telescope	35.08		11.79	13.80	10.84
1240-757-9927	M4 Sight	3.56		3.84	4.62	3.59
1240-757-9933	M1 Panoramic Telescope	17.55		8.94	8.92	8.62
1240-757-9935	M12 Panoramic Telescope	34.69		16.00	17.35	12.38
1240-757-9975	M62 Elbow Telescope	9.58		4.51	5.14	2.47
1240-759-7757	M15A1 Periscope	87.49		16.56	19.48	16.30
1240-759-7774	M84 Telescope	3.85		3.58	3.75	3.14

<u>FSN</u>	<u>Nomenclature</u>	<u>Unit Weighted Average</u>			<u>Manhour Experience Range</u>	
		<u>Funded Parts (73\$)</u>	<u>Unfunded Parts (73\$)</u>	<u>Manhours</u>	<u>High</u>	<u>Low</u>
1240-759-7781	M16A1D Elbow Telescope	23.99	.08	5.60	6.18	5.14
1240-759-7782	M16A1F Elbow Telescope	11.48		8.15	8.40	7.33
1240-759-7783	M16A1G Elbow Telescope	10.64		4.96	4.96	4.96
1240-759-7852	M86F Telescope	14.31		5.93	6.42	5.00
1240-759-7853	M90D Telescope	17.84		6.28	6.82	4.76
1240-759-7854	M34 Sight, Unit	42.67		12.79	14.52	11.92
1240-762-9333	M19 Articulated Telescope	22.69	8.09	22.75	22.75	22.75
1240-764-1667	M105 Articulated Telescope	54.91	.04	18.34	26.68	16.86
1240-764-7931	M34A1 Sight Unit	38.08		11.63	13.05	10.96
1240-764-8288	M24C Sight Unit	28.91		4.74	4.92	3.86
1240-764-8432	M90C Telescope	4.65		5.91	5.91	5.91
1240-768-1260	M12A7C Panoramic Telescope	27.15		14.09	15.02	11.78
1240-768-7261	M12A7D Panoramic Telescope	15.05	.18	11.42	11.42	11.42
1240-768-7263	M12A7F Panoramic Telescope	19.89		12.00	12.00	12.00
1240-768-1236	M103 Telescope	358.00		4.35	4.47	4.16
1240-819-4519	M118 Elbow Telescope	100.72	.01	33.62	37.85	19.25
1240-819-4520	M118C Elbow Telescope	128.34		38.42	39.89	37.00

FSN	Nomenclature	Unit Weighted Average		Manhour Experience Range	
		Funded	Unfunded	High	Low
		Parts (73\$)	Parts (73\$)	Manhours	
1240-824-3467	M62A1C Elbow Telescope	15.86		3.58	5.00 3.20
1240-863-5642	M17B1C Range Finder	1558.40	222.29	122.38	159.70 49.50
1240-864-2930	M117 Panoramic Telescope	128.71	20.89	42.19	48.75 29.81
1240-864-2933	M42 Periscope	1.46		4.00	4.38 3.20
1240-875-7933	M17A1 Range Finder	305.27	21.44	94.86	96.83 84.60
1240-886-5888	M92F Elbow Telescope	11.61	9.56	5.40	6.54 4.76
1240-895-9186	M115 Panoramic Telescope	324.04		35.83	39.49 27.00
1240-898-6787	M116 Elbow Telescope	51.29		5.31	6.00 4.66
1240-898-6789	M116C Elbow Telescope	37.53		8.41	10.00 6.00
1240-917-6428	M12A7Q Panoramic Telescope	37.17	3.89	13.14	14.19 10.30
1240-917-6433	M12A7S Panoramic Telescope	45.41	.16	15.10	16.92 11.33
1240-924-5783	M103A1 Telescope	26.32	.27	4.82	5.12 4.44
1240-933-5630	XM44E1 Periscope	419.27	303.91	58.20	58.20 58.20
1240-963-0839	M114 Elbow Telescope	407.56		25.54	100.00 8.00
1240-974-6432	M116F Elbow Telescope	21.50	10.48	5.25	5.25 5.25
1240-974-6433	M116D Elbow Telescope	10.96		6.00	6.00 6.00
1240-977-5586	M24 Range Finder	105.75		159.00	159.00 159.00

<u>FSN</u>	<u>Nomenclature</u>	<u>Unit Weighted Average</u>		<u>Manhour Experience Range</u>	
		<u>Funded Parts (73\$)</u>	<u>Unfunded Parts (73\$)</u>	<u>High</u>	<u>Low</u>
1240-980-1745	M105D Articulate Telescope	55.22	13.13	26.09	16.40
1240-980-9288	M32 Periscope	133.15	15.08	35.95	12.59
1240-980-9290	M34 Periscope	184.20		40.50	28.00
1240-980-9291	M36 Periscope	267.85	2.97	37.67	36.17
1240-990-1851	M28D Periscope	17.74		10.79	10.79
1290-346-8184	M24 Tripod Mount	5.30		3.65	2.05
1290-652-8560	M5 Tripod Mount	1.25		5.12	1.10

FS#	Nomenclature	Unit Weighted Average		Manhour Experience Range	
		Funded Parts (73\$)	Unfunded Parts (73\$)	Manhours	High Low
2350-049-4791	M42A1 Anti-aircraft SP Artillery	8362.	1960.	1994.42	2049.54 1942.59
2350-301-8456	M48A1 Tank 90 mm	15792.	3825.	2011.48	2119.98 1626.30
2350-436-6635	M107 SP Gun 175 mm	21288.	8530.	2555.89	2605.07 2453.04
2350-439-6242	M578 Recovery Vehicle	15403.	3235.	2506.39	2533.80 2503.85
2350-439-6243	M110 SP Howitzer 8 in	23004.	11771.	2464.49	2639.00 2020.40
2350-440-8810	M108 SP Howitzer 105 mm	15743.	4711.	2456.73	2662.43 1983.43
2350-440-8811	M109 SP Howitzer 155 mm	21144.	1362.	2148.69	2427.31 1467.87
2350-503-7966	M44A1 SP Howitzer 155 mm	96204.	1061.	2062.56	2309.24 1908.45
2350-563-7967	M52A1 SP Howitzer 105 mm	8398.	713.	2187.04	2523.71 1927.64
2350-566-4087	M41A3 Tank 76 mm	10335.	1269.	2074.54	2128.07 1867.84
2350-678-5772	M88 Recovery Vehicle	11934.	824.	2696.04	3281.45 2384.15
2350-678-5773	M60 Tank 105 mm	15854.	1652.	2274.35	2301.00 2174.18
2350-679-4812	M48A2C Tank 90 mm	15892.	1365.	2236.68	2971.97 2052.95
2350-736-4202	M42 Tank 90 mm	15876.	2744.	2172.92	2338.81 1764.29
2350-738-6846	M41 Tank 76 mm	7053.	2935	2565.50	2565.50 2565.50
2350-739-3840	M53 Gun 155 mm	17488.	10854.	3650.30	3699.60 3412.00
2350-756-8497	M60A1 Tank 105 mm	14584.	1756.	2279.37	2923.67 2172.68
2350-795-1797	M728 Engineering Vehicle	11929.	14183.	2700.67	2700.67 2700.63

<u>FSN</u>	<u>Nomenclature</u>	<u>Unit Weighted Average</u>		<u>Manhour Experience Range</u>	
		<u>Funded</u>	<u>Unfunded</u>	<u>High</u>	<u>Low</u>
		<u>Parts (73\$)</u>	<u>Parts (73\$)</u>		
2350-796-8000	M42 Anti-aircraft SP Artillery	9295.	3189.	2254.86	1730.23
2350-835-8713	M51 Recovery Vehicle	21023.	1885.	4482.00	3999.89
2350-873-5408	M551 Armored Recon. Vehicle	23881.	5709.	2326.08	2033.75
2350-895-9154	M48A3 Tank 90 mm	15777.	9703.	2203.42	1831.33

FSN	Nomenclature	Unit Weighted Average		Manhour Experience Range	
		Funded Parts (73\$)	Unfunded Parts (73\$)	High	Low
50-344-4647	M24 Periscope	76.30	.03	13.26	10.83
50-530-0959	M15A1 Binocular	3.63		7.49	7.49
50-530-0960	M49 Observation Telescope	9.13		5.85	4.29
50-530-0973	M13A1 Binocular	17.20		7.50	7.06
50-530-0974	M17A1 Binocular	16.61		7.33	6.90
50-670-2491	M3 Binocular	19.12	.02	8.54	6.04
50-670-2508	M13 Binocular	30.26		9.48	7.56
50-670-2514	M16 Binocular	12.63	.04	8.75	5.26
50-678-5577	M65 BC Telescope	75.57		32.69	20.46
50-762-9336	XM48 Periscope	383.50	1.22	19.73	14.70
50-765-2971	M19 Periscope	81.98		12.64	10.02
50-788-5464	XM47 Periscope	297.88	3.05	4.72	4.72
50-863-5657	M18 Infrared Binocular	138.79	1.54	25.57	14.60

2. OCOMUS Depot Overhaul

FSN	Nomenclature	Unit Weighted Average			Manhour Experience Range	
		Funded Parts (73\$)	Unfunded Parts (73\$)	Manhours	High	Low
1015-322-9720	M30 Mortar 107 mm	748.97		22.48	22.48	22.48
1015-322-9752	M101A1 Howitzer 105 mm	2406	619.40	584.14	601.00	582.45
1015-348-4923	M40A1 Recoilless Rifle	348.40	45.77	61.81	61.81	61.81
1240-360-1593	M97 Telescope	53.81		30.00	30.00	30.00
2350-436-6635	M107 SP Gun 175 mm	7296	1528	1142.78	1877.14	838.40
2350-439-6243	M110 SP Howitzer 8"	9390	2897	1588.60	2091.60	708.35
2350-440-8810	M108 SP Howitzer 105 mm	8357	37.09	323.75	323.75	323.75
2350-440-8811	M109 SP Howitzer 155 mm	7371	284.80	1751.62	1819.66	1232.88
2350-678-5772	M88 Recovery Vehicle	9471	145.88	1800.00	1800.00	1800.00
2350-678-5773	M60 Tank 105 mm	17141	743.23	1040.47	1040.47	1040.47
2350-756-8497	M60A1 Tank 105 mm	18118	778.34	1384.87	1384.87	1384.87
2350-895-9154	M48A3 Tank 90 mm	22738	3176	3010.36	3010.36	3010.36
6650-530-0960	M49 Observation Telescope	33.36		*	*	*
6650-670-2491	M3 Binocular	19.43		12.00	12.00	12.00
6650-863-5657	M18 Infrared Binocular	122.47		5.55	5.55	5.55

* Hours not reported

COST ESTIMATING RELATIONSHIPS (CER'S)

SECTION III

The CER's presented in this section are statistically derived expressions relating CONUS depot unit overhaul cost in FY 73 dollars (the dependent variable) to one or more independent variables. The independent variables are characteristics regarded as cost drivers. These characteristics are usually physical or performance in nature with the exception of standard price which is defined in Appendix A. Cost estimates are obtained from the CER's by substituting the values of the independent variables in the expression and solving the expression for the dependent variable.

The CER's were derived by evaluating potential cost drivers as candidate independent variables. Consideration was given to the restraint that the independent variables must be known at the time the cost estimate is made. Major item overhaul costs used as dependent variable values were determined by multiplying the item unit weighted average manhours found in Section II-A by \$12.13 (composite FY 73 CONUS depot rate) and adding the item unit weighted average funded parts cost found in Section II-A. After collecting historical data on the independent and dependent variables, CER's were developed based on standard regression analysis theory. After performing the regression analyses, correlation analysis was used to select valid CER's.

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The following statistics are presented with each of the CER's in this section. These statistics follow from the correlation analysis and give an indication of how well the CER explains the

relationship between the independent and dependent variables.

1. Coefficient of Determination. This number indicates the percentage of total variation of the dependent variable that is explained by the regression. The value falls within the range of 0 (no correlation among the variables) to 1 (perfect correlation). The F distribution was used to determine whether the coefficients of determination are significant, that is, whether the obtained coefficients of determination are large enough to be considered as showing true relationships between the independent and dependent variables. The criteria used for significant correlation was a 0.10 or less level of significance. The level of significance establishes the chance of rejecting the hypothesis that the population coefficient of determination is zero when in fact the hypothesis is true.

2. Standard Error of Estimate. This is an absolute measure of the dispersion of the estimated values of the dependent variable from the actual values. Generally, the lower the standard error of estimate for a given regression the better the fit between the regression line and the actual data points. The standard error of estimate is used to determine the following:

- a. Coefficient of variation
- b. Confidence intervals
- c. Prediction intervals

3. Mean Absolute Percent Deviation. The mean absolute percent deviation (MAPD) is a relative measure of the average of the absolute values of the percent deviations between the actual and calculated dependent variable values. Algebraically written MAPD equals

$$\frac{100}{n} \cdot \sum_{i=1}^n \left| \frac{\hat{Y}_i - Y_i}{Y_i} \right|$$

where $\hat{Y}$ and Y are the calculated and actual dependent variable values respectively and n is the number of data points.

4. Coefficient of Variation. The coefficient of variation is a relative measure of the ratio of the standard error of estimate to the mean of the actual dependent variable values. The ratio is most useful for comparing the relative worth of different regressions. As a rule of thumb, a good regression should have a coefficient of variation of 0.20 or less.

Limitations. In general, CER's are most useful for estimating costs in the early stages of weapon system development. They may be used later in the life cycle as a validation of or complement to other cost estimating methods. For estimating costs with very close historical counterparts, the analogy method of cost estimating is probably more accurate. Caution should be used in estimating costs of weapon systems which represent major technological advances since the data upon which the CER's are based may be irrelevant to the new weapon systems. Finally, of course, the CER's should not be used for estimating costs when an independent variable value diverges from the range of the data upon which the CER's are based.

CAL. 30 RIFLES

Equation: $\hat{Y} = -18.020 + 0.516 X$

where $\hat{Y}$: calculated unit overhaul cost in FY 73 dollars.

X: standard price

Coefficient of determination = .864

Standard error of estimate = 19.39

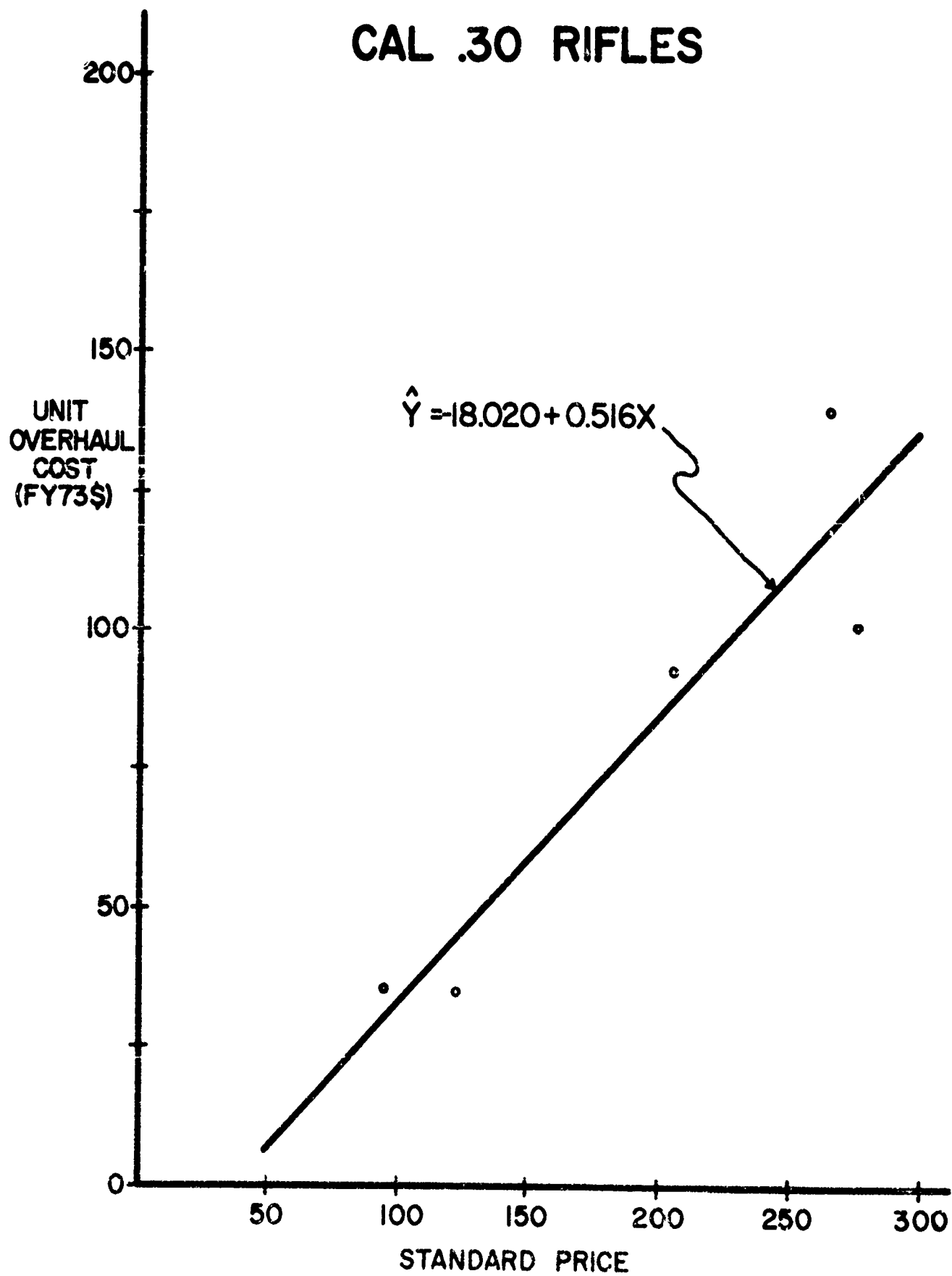
Mean absolute percent deviation = 17.02

Coefficient of variation = .238

<u>Item</u>	<u>X-Std Price</u>	<u>Y-Actual Cost</u>	<u>$\hat{Y}$-Calc Cost</u>
M14	122	35.17	44.95
M1	94.30	35.81	30.65
M14A1	206	93.33	88.31
M1D	275	101.60	123.92
M1918A2 BAR	265	140.71	118.76

Graphical representation of the above equation is presented on the following page.

CAL .30 RIFLES



REVOLVERS AND PISTOLS

Revolvers and pistols were grouped together because small parts and complexity of these would exhibit similar costs. Due to the small range of unit overhaul costs exhibited by revolvers and pistols no CER is developed. Therefore, the unit overhaul costs are best stated as having the mean value of \$25.49 in FY 73 dollars.

<u>Item</u>	<u>Unit Overhaul Cost</u>
Revolver Cal. 38 (FSN 1005-214-0934)	\$26.74
Revolver Cal. 38 (FSN 1005-726-5687)	26.75
Revolver Cal. 38 (FSN 1005-726-5786)	23.54
M1911A1 Pistol Cal. 45	24.91

MACHINE GUNS

$$\text{Equation: } \hat{W} = 247.702 - 541.810X + 0.072Y + 1.294Z$$

where $\hat{W}$: calculated unit overhaul cost in FY 73 dollars

X: bore size (caliber)

Y: standard price

Z: weight (lbs)

Coefficient of determination = .927

Standard error of estimate = 37.20

Mean absolute percent deviation = 15.41

Coefficient of variation = .206

<u>Item</u>	<u>X-Caliber</u>	<u>Y-Std Price</u>	<u>Z-Weight</u>	<u>W-Actual Cost</u>	<u>$\hat{W}$-Calc Cost</u>
M3A1	.45	111	8.06	26.06	22.36
M2 (FSN 1005-606-8412)	.50	900	80	110.93	145.50
M37	.30	341	34.7	117.33	154.76
M2 (FSN 1005-957-3893)	.50	900	80	124.89	145.50
M60	.30	708	23.16	147.22	166.39
M2 (FSN 1005-322-9715)	.50	1026	82	148.49	157.21
M1919A4	.30	297	31	148.56	146.79
M1919A6	.30	463	32.5	155.22	160.75
M2 (FSN 1005-602-2105)	.50	700	80	170.07	131.02
M2 (FSN 1005-693-4854)	.50	900	80	190.13	145.50
M73	.30	2513	29.31	364.65	305.04
M85	.50	5829	65	460.84	482.95

RECOILLESS RIFLES

Equation: $\hat{\text{LnY}} = 5.308 + 0.00545X$

or $\hat{Y} = \text{Antiln} (5.308 + 0.00545X)$

where $\hat{Y}$: calculated unit overhaul cost in FY 73 dollars

X: weight (lbs)

Definition: Antiln is the natural (Naperian) antilogarithm or
antilogarithm to the base e.

(e = 2.718....).

Coefficient of determination = .955

Standard error of estimate = 57.88

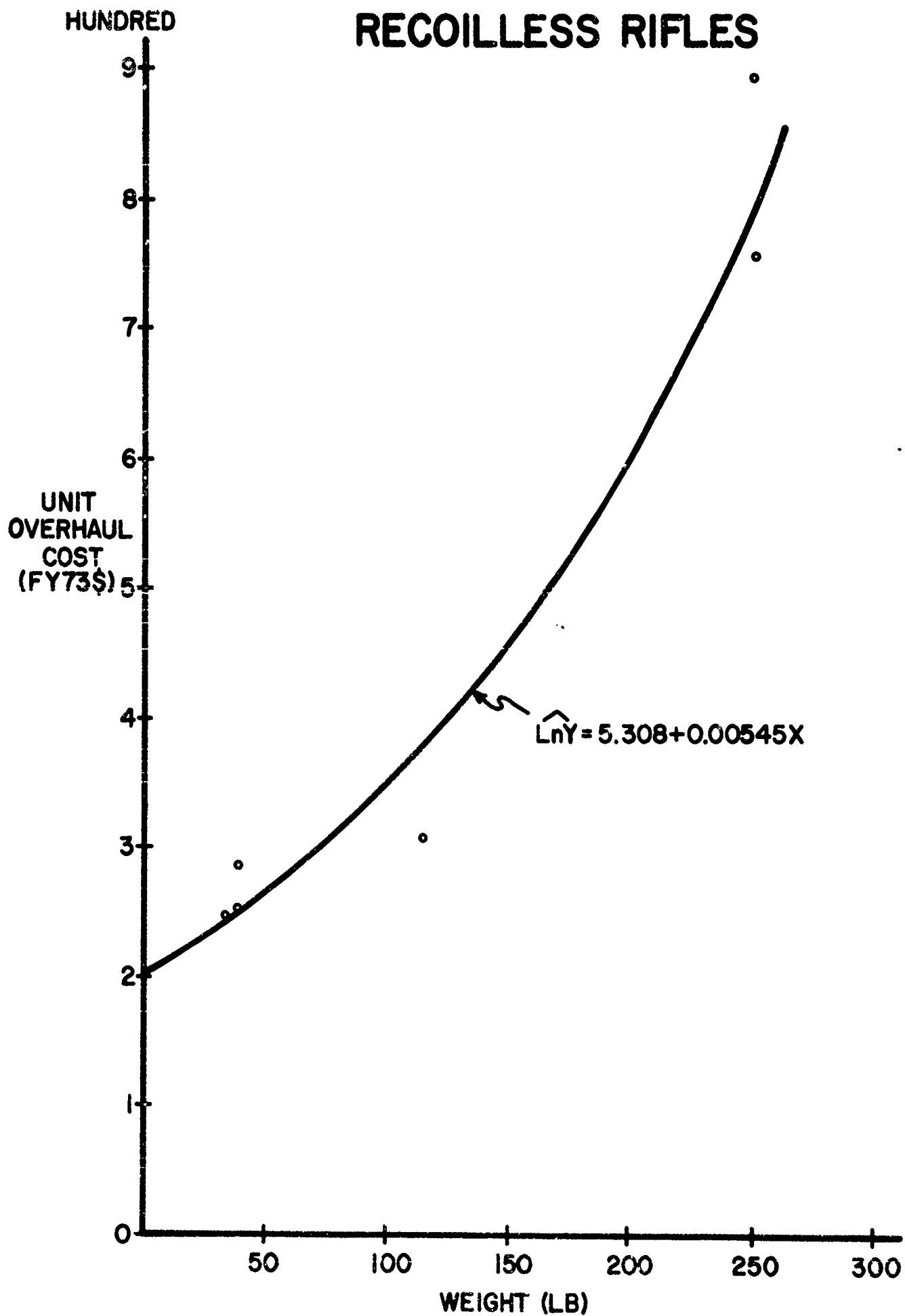
Mean absolute percent deviation = 8.72

Coefficient of variation = .127

<u>Item</u>	<u>X-Weight</u>	<u>Y-Actual Cost</u>	<u>$\hat{Y}$-Calc Cost</u>
M67	35	246.44	244.45
M18A1	40.25	249.97	251.55
M18	40.25	286.82	251.55
M20	114.5	306.98	377.05
M40A1	251	758.29	793.49
M40A2	251	892.89	793.49

Graphical representation of the above equation is presented on the
following page.

RECOILLESS RIFLES



MORTARS

Equation: $\hat{Y} = -2394 + 631.46 (\ln X)$

where $\hat{Y}$: calculated unit overhaul cost in FY 73 dollars

X: bore size (mm)

Coefficient of determination = .863

Standard error of estimate = 85.53

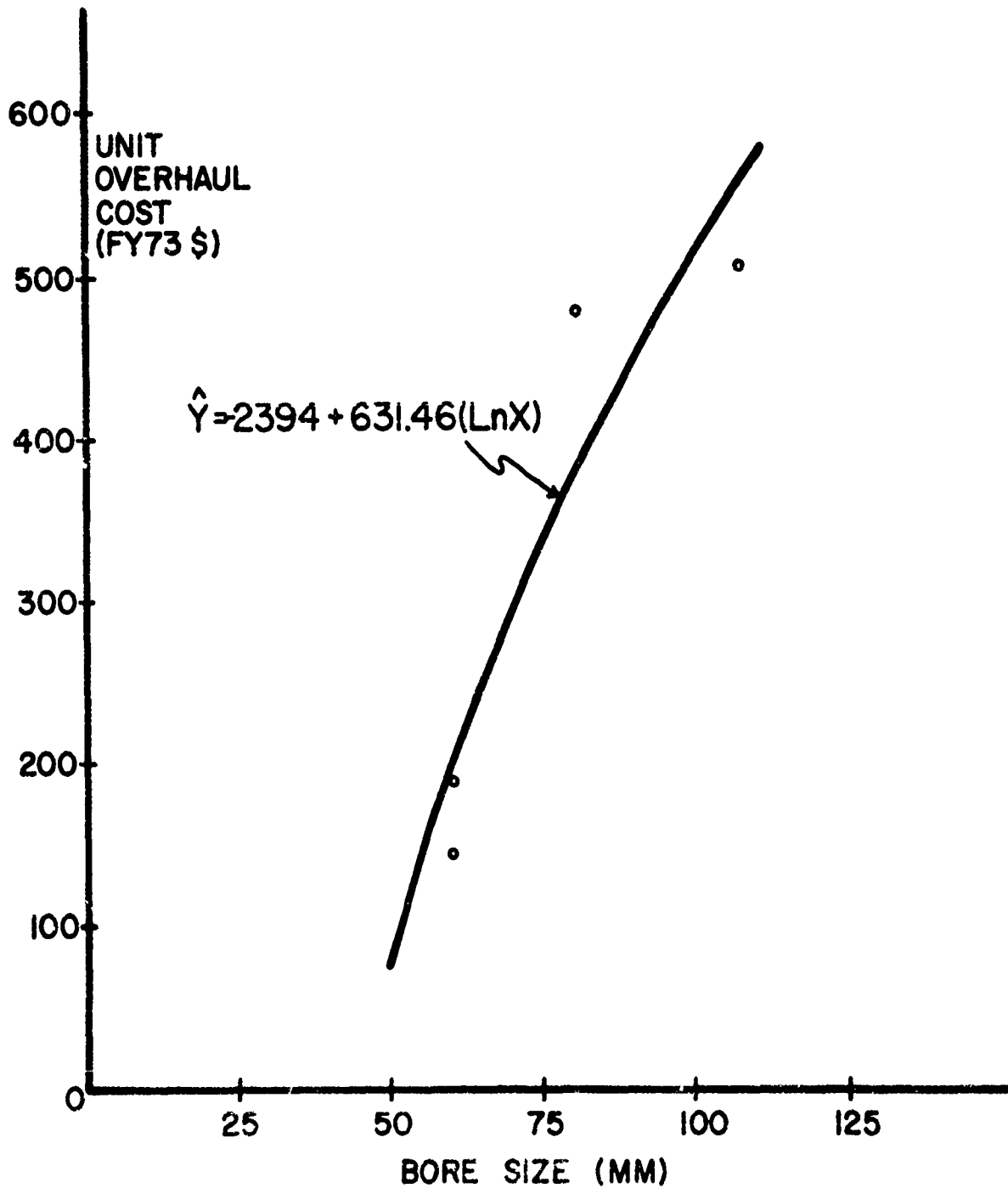
Mean absolute percent deviation = 13.8%

Coefficient of variation = .259

<u>Item</u>	<u>X-MM</u>	<u>Y-Actual Cost</u>	<u>$\hat{Y}$-Calc Cost</u>
M19	60	144.72	191.40
M2	60	190.44	191.40
M29	81	479.95	380.91
M30	107	505.32	556.69

Graphical representation of the above equation is presented on the following page.

MORTARS



RECOIL MECHANISMS

Equation: $\hat{Y} = -3639 + 3.367X$

where $\hat{Y}$: calculated unit overhaul cost in FY 73 dollars

X: muzzle velocity of end item application (ft/sec)

Coefficient of determination = .964

Standard error of estimate = 141.68

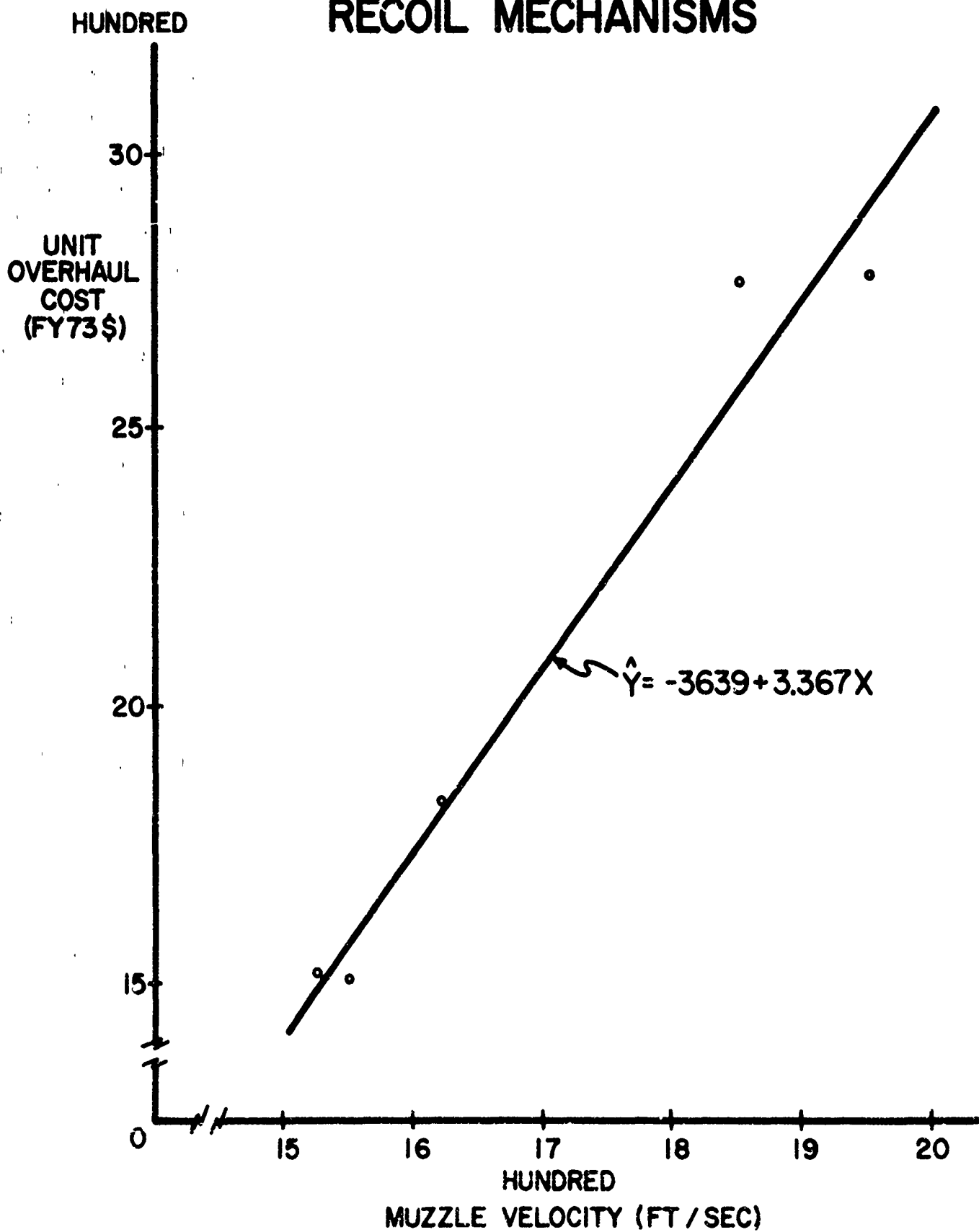
Mean absolute percent deviation = 3.62

Coefficient of variation = .068

<u>Item</u>	<u>End Item Application</u>	<u>X-Muzzle Vel</u>	<u>Y-Actual Cost</u>	<u>Y-Calc Cost</u>
M2A4	M101 How	1550	1508.93	1580.13
M2A5	M101A1 How	1526	1514.99	1499.32
M37	M102 How	1621	1829.27	1819.20
M6A2	M114 How	1850	2777.01	2590.30
M4A1	M115 How	1949	2782.43	2923.65

Graphical representation of the above equation is presented on the following page.

RECOIL MECHANISMS



TOWED HOWITZERS

Equation: $\hat{Y} = 4480 + 0.319X$

where $\hat{Y}$: calculated unit overhaul cost in FY 73 dollars

X: applied momentum (lbs - sec)

Coefficient of determination = .960

Standard error of estimate = 522.40

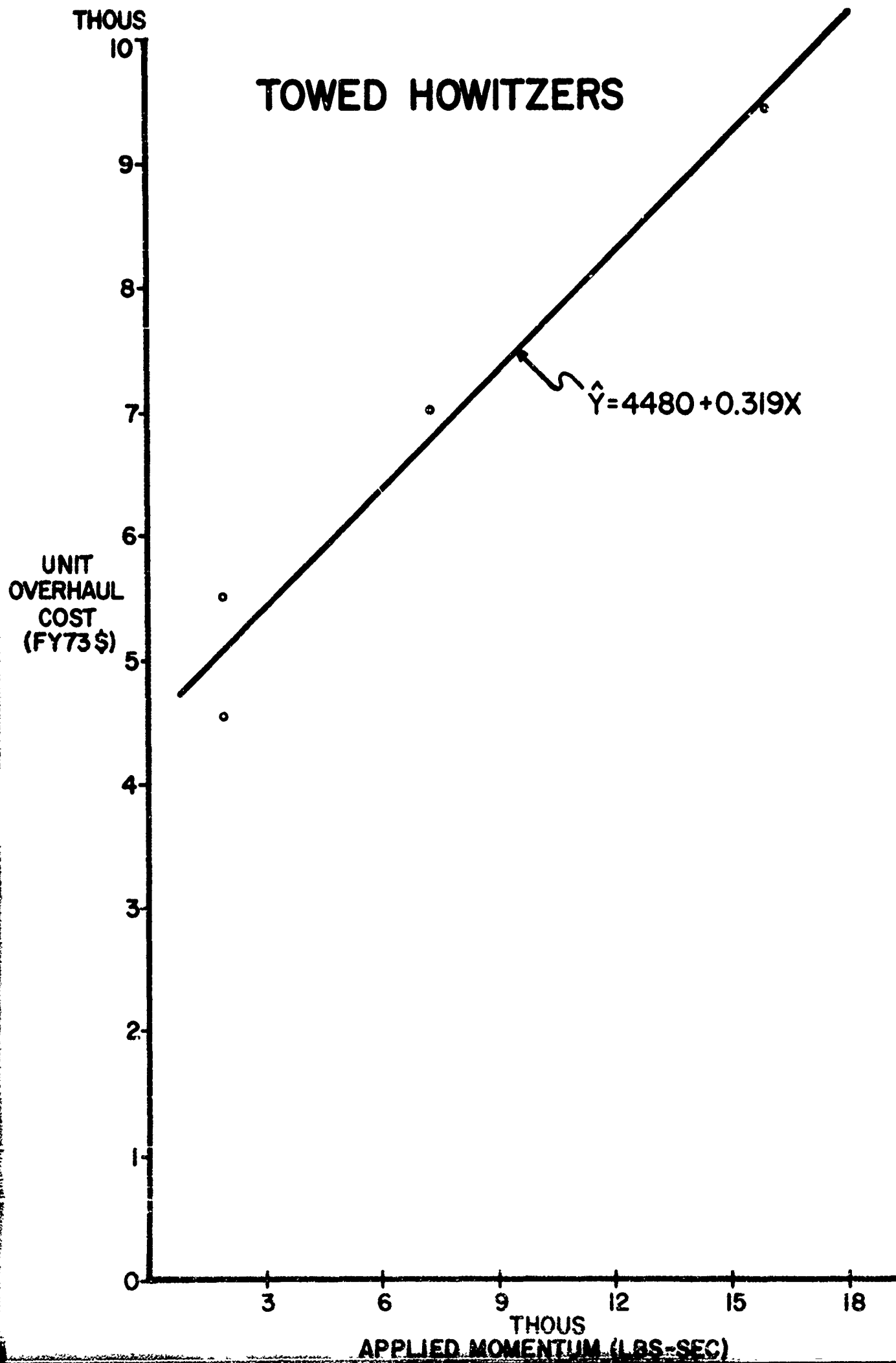
Mean absolute percent deviation = 6.03

Coefficient of variation = .079

<u>Item</u>	<u>X-Applied Momentum</u>	<u>Y-Actual Cost</u>	<u>$\hat{Y}$-Calc Cost</u>
M101A1	1,950	4,543	5,102
M102	1,923	5,502	5,093
M114/A1	7,250	7,032	6,791
M115	15,870	9,447	9,538

Graphical representation of the above equation is presented on the following page.

TOWED HOWITZERS



SELF-PROPELLED HOWITZERS

Equation: $\hat{Y} = -306389 + 32123 (\ln X)$

where $\hat{Y}$: calculated unit overhaul cost in FY 73 dollars

X: weight (lbs)

Coefficient of determination = .500

Standard error of estimate = 8131

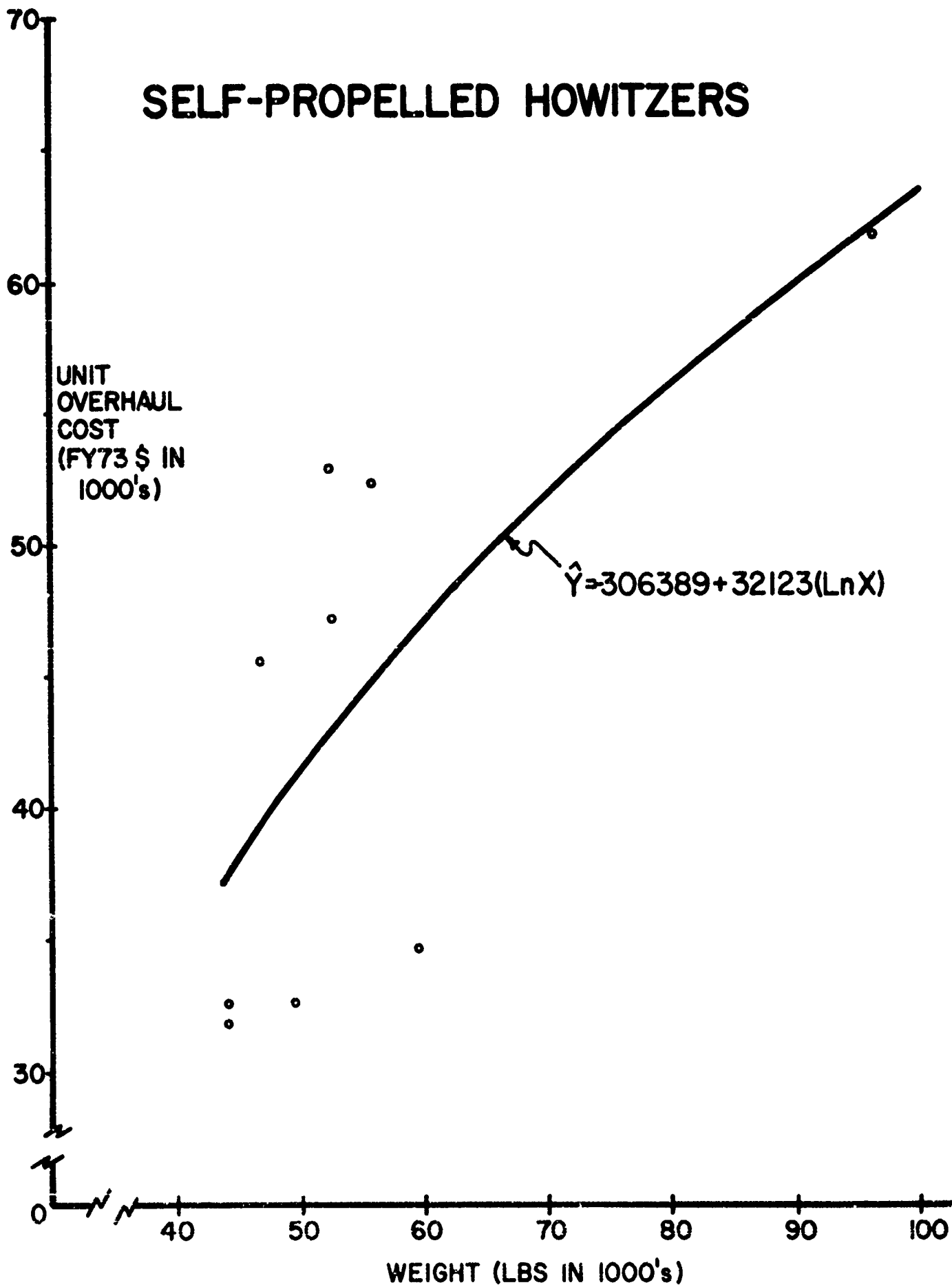
Mean absolute percent deviation = 15.84

Coefficient of variation = .186

<u>Item</u>	<u>X-Weight</u>	<u>Y-Actual Cost</u>	<u>$\hat{Y}$-Calc Cost</u>
M42	44,300	31,805	37,288
M42A1	44,300	32,554	37,288
M44A1	59,500	34,639	46,764
M52A1	49,800	34,927	41,047
M108	46,921	45,543	39,134
M109	52,461	47,208	42,719
M107	55,800	52,291	44,701
M110	52,200	52,898	42,559
M53	96,000	61,766	62,131

Graphical representation of the above equation is presented on the following page.

SELF-PROPELLED HOWITZERS



STRAIGHT TELESCOPES

Straight telescopes with standard price less than \$600 were included in this section.

$$\text{Equation: } \hat{Y} = 36.698 + 0.289 X$$

where $\hat{Y}$: calculated unit overhaul cost in FY 73 dollars

X: standard price

Coefficient of determination = .784

Standard error of estimate = 24.74

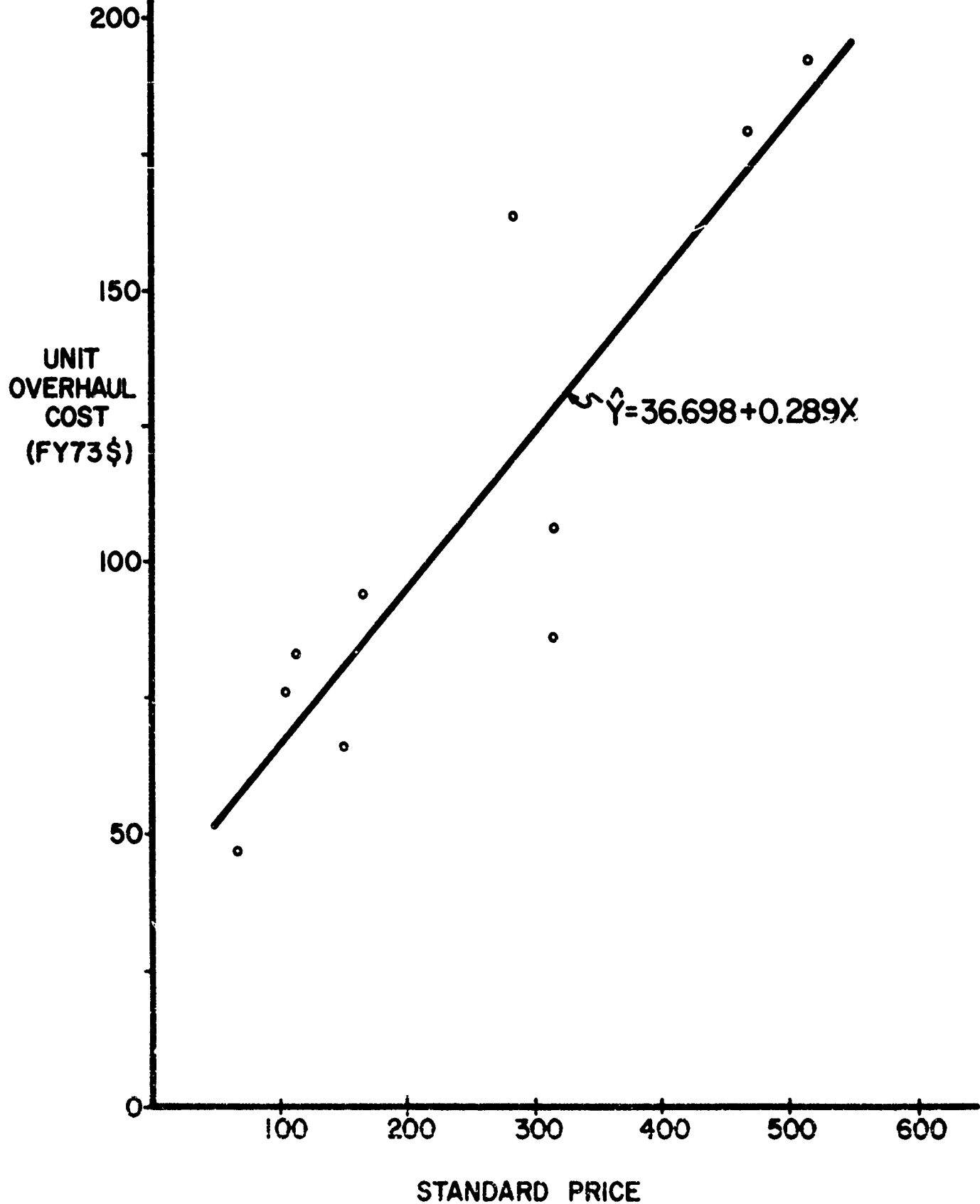
Mean absolute percent deviation = 18.35

Coefficient of variation = .226

<u>Item</u>	<u>X-Std Price</u>	<u>Y-Actual Cost</u>	<u>$\hat{Y}$-Calc Cost</u>
M84	70.44	47.28	57.03
M49	153	65.54	80.86
M90C	107	76.34	67.58
M103A1	118	84.79	70.76
M86F	315	86.24	127.64
M90D	169	94.02	85.48
M90F	316	106.15	127.92
M97C	286	163.41	119.26
M97H	468	178.09	171.81
M97	514	191.63	185.09

Graphical representation of the above equation is presented on the following page.

STRAIGHT TELESCOPES



ELBOW TELESCOPES

Elbow telescopes with a standard price less than \$250 were included in this section.

$$\text{Equation: } \hat{Y} = 40.860 + 0.344X$$

where $\hat{Y}$: calculated unit overhaul cost in FY 73 dollars

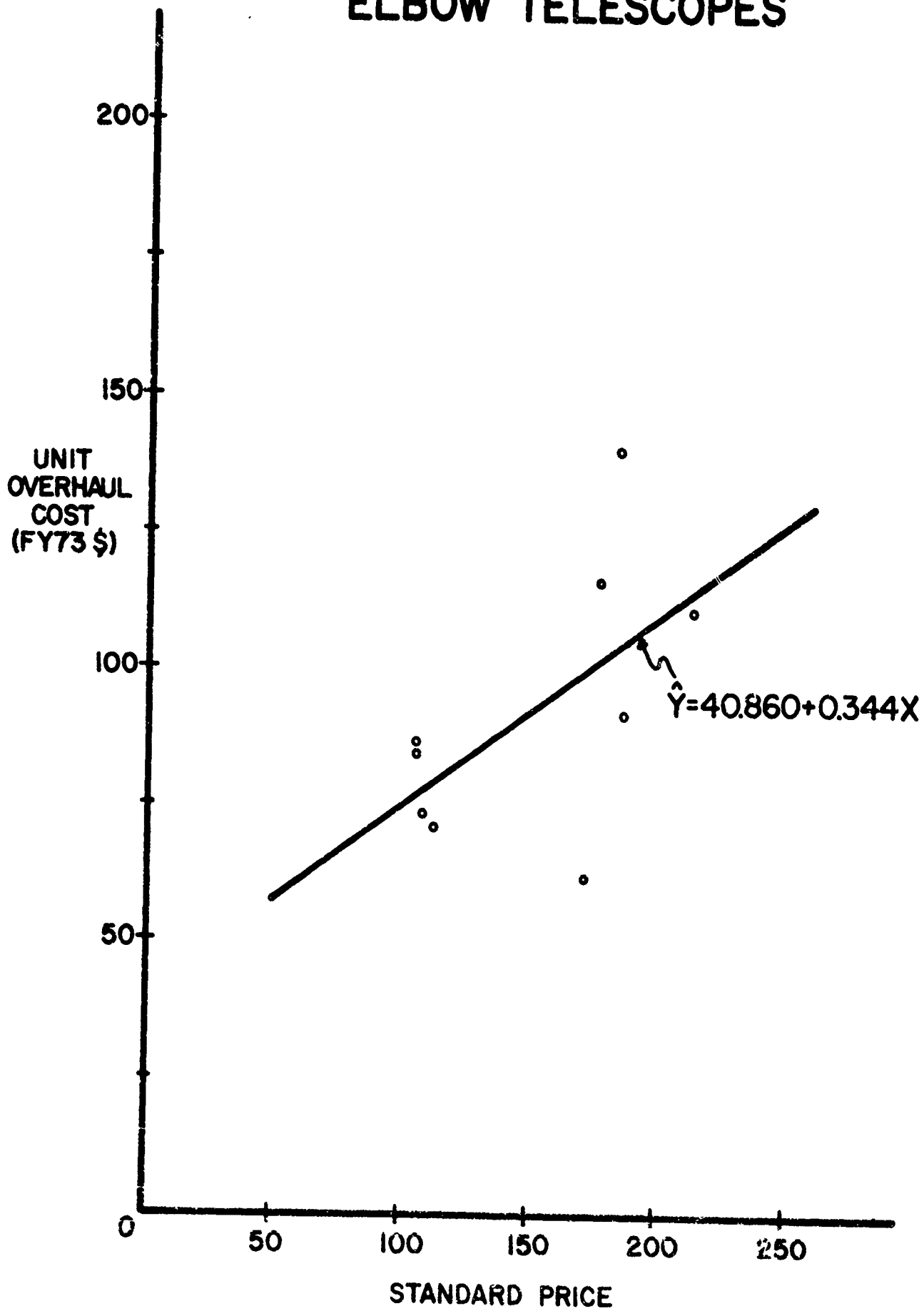
X: standard price

Coefficient of determination	=	.345
Standard error of estimate	=	21.61
Mean absolute percent deviation	=	16.83
Coefficient of variation	=	.234

<u>Item</u>	<u>X-Std Price</u>	<u>Y-Actual Cost</u>	<u>$\hat{Y}$-Calc Cost</u>
M62 Series	170	61.79	99.25
M16A1G	111	70.81	78.99
M92 Series	107	73.15	77.61
M116D	105	83.74	76.92
M116F	105	85.18	76.92
M16A1D	185	91.92	104.40
M16A1F	212	110.34	113.68
M116	173	115.70	100.28
M116C	184	139.54	104.06

Graphical representation of the above equation is presented on the following page.

ELBOW TELESCOPES



TANK PERISCOPES

Equation: $\hat{Y} = 1.494X^{0.773}$

where $\hat{Y}$: calculated unit overhaul cost in FY 73 dollars

X: standard price

Coefficient of determination = .939

Standard error of estimate = 67.12

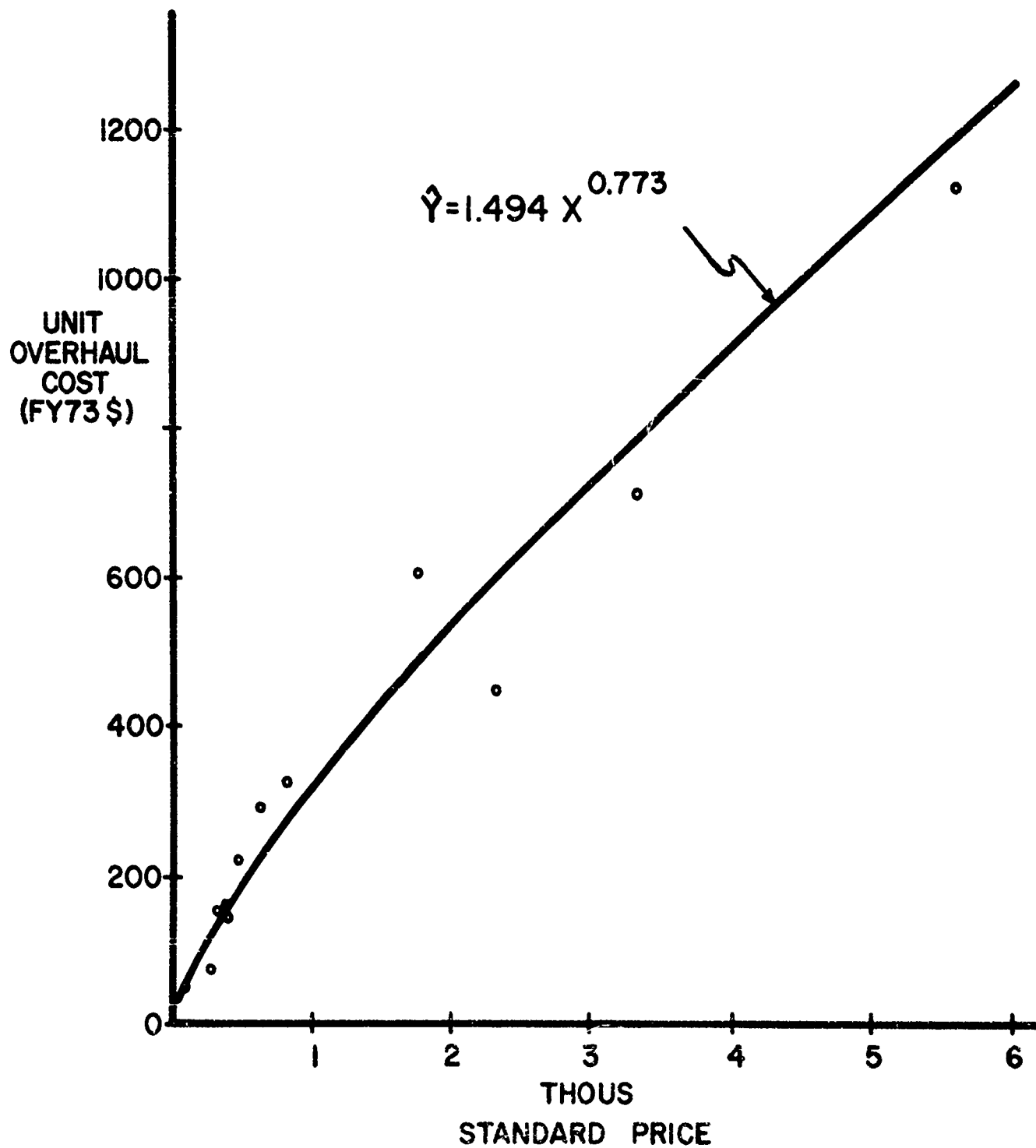
Mean absolute percent deviation = 18.62

Coefficient of variation = .187

<u>Item</u>	<u>X-Std Price</u>	<u>Y-Actual Cost</u>	<u>$\hat{Y}$-Calc Cost</u>
M42	107	49.98	55.44
M23	291	74.25	120.19
M28	327	150.62	131.54
M28D	398	148.62	153.13
M28C	398	160.28	153.13
M24	484	220.53	178.14
M15A1	632	288.36	218.97
M31	823	323.53	268.59
M34	1779	603.78	487.54
M32	2320	446.35	598.67
M36	3326	708.53	791.00
XM44E1	5600	1125.24	1183.51

Graphical representation of the above equation is presented on the following page.

TANK PERISCOPES



SIGHTS

Equation: $\hat{Y} = 0.169X^{1.206}$

where $\hat{Y}$: calculated unit overhaul cost in FY 73 dollars

X: standard price

Coefficient of determination = .896

Standard error of estimate = 20.24

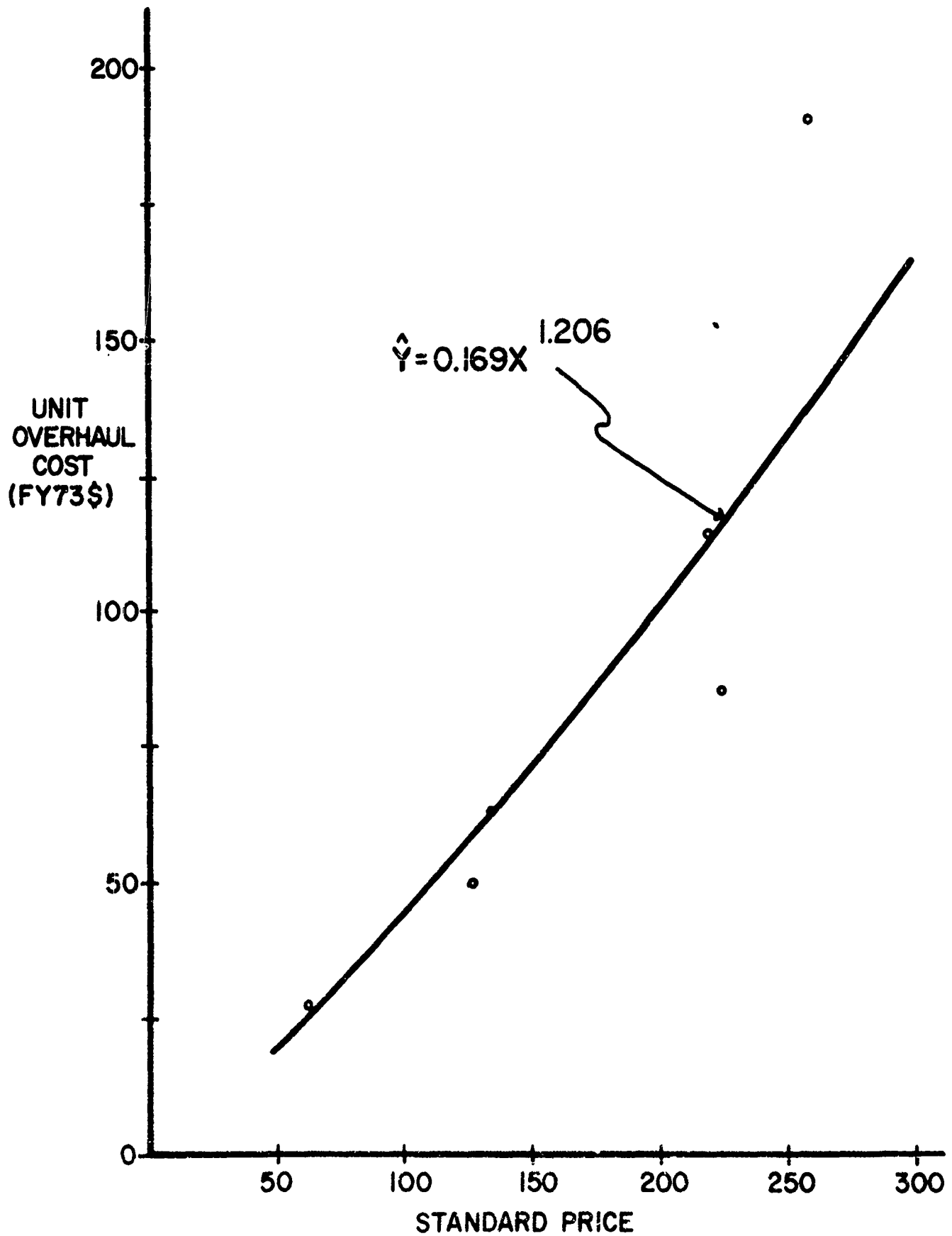
Mean absolute percent deviation = 15.08

Coefficient of variation = .228

<u>Item</u>	<u>X-Std Price</u>	<u>Y-Actual Cost</u>	<u>$\hat{Y}$-Calc Cost</u>
Sight, reflecting (FSN 1240-716-2947)	63.22	27.80	25.06
M4 Sight	128	50.14	58.67
M44C Infinity Sight	135	62.91	62.56
M24C Sight Unit	225	86.41	115.83
Infinity Sight (FSN 1240-056-4854)	221	114.05	113.35
M34 Sight Unit Series	258	190.96	136.61

Graphical representation of the above equation is presented on the following page.

SIGHTS



TANKS

Due to the small range of unit overhaul cost exhibited by tanks no CER is developed. Therefore, the unit overhaul costs are best stated as having the mean value of \$41,103 in FY 73 dollars.

<u>Item</u>	<u>Unit Overhaul Cost</u>
M41A3	\$35499
M48A1	40191
M48A3	41097
M60A1	42233
M48	42234
M48A2C	43023
M60	43442

APPENDIX A

DEFINITIONS

Cyclic/Normal Overhaul/Rebuild (WAC Code A1) - To restore an item to a standard as nearly as possible to original or new condition in appearance, performance and life expectancy. This is accomplished through the maintenance technique of complete disassembly of the item, inspection of all parts or components, repair or replacement of worn or unserviceable elements using original manufacturing tolerances and specifications and subsequent reassembly of the item. Also includes the disassembly, testing, and inspecting of the operating components and the basic structure to determine and accomplish the necessary rework, replacement, and servicing required to obtain the desired performance and permit the return of an item to the supply system in accordance with maintenance standards established for each item of equipment (AR 750-1). Includes overhaul performed on site when such maintenance requires the skills, tools and equipment of depot maintenance personnel and facilities. Includes the overhaul/rebuild of equipment returned on a cyclic basis to depot maintenance activities based on hours of operation, mileage, or other established operational criteria, in addition to normal returns based on technical inspections. Includes rebuild only when approved by DA/DCSLOG.

Funded Parts - Army Stock Funded (ASF) Parts. ASF parts required for overhaul are charged to the project program.

Standard Price - A predetermined price established in accordance with prescribed criteria for each item in the Army supply system. See AR 735-7 for standard price objectives.

Unfunded Parts - PEMA (free issue) Parts. PEMA funded parts required for overhaul are not charged to the project program.

APPENDIX B

AVERAGE ANNUAL UNIT COST TO OVERHAUL (EXCLUDING UNFUNDED PARTS COST) BY MAJOR ITEM IN FY 73 DOLLARS

This appendix provides a historical summary by item by which assumptions can be made concerning future overhaul/rebuild costs. The following pages present the weighted average unit cost to overhaul excluding unfunded parts cost in FY 73 dollars by fiscal year for the major items listed in Section II. Data are displayed in FSN numerical sequence for both CONUS and OCONUS depot overhaul.

1. CONUS Depot Overhaul

FSN	NOMENCLATURE	ANNUAL AVERAGE UNIT COST (EXCLUDING UNFUNDED PARTS) TO OVERHAUL IN FY 73 DOLLARS					
		FY 66	67	68	69	70	71 72
005-072-5011	M14A1 Rifle 7.62 MM		62.30	103.39	90.49	93.29	
005-073-9421	M16A1 Rifle 5.56MM						61.97
005-214-0934	S&W Revolver Cal 38		24.15	34.98		30.79	
005-317-2425	M36 Gun Mount		170.51	181.34	175.61	245.61	
005-317-2427	M36A1 Gun Mount		175.48	200.51		231.34	214.28
005-317-2428	M36A2 Gun Mount	132.78	247.25	238.24	235.53		
005-317-2442	M31 C Pedestal Mount				100.08	124.12	
005-322-9715	M2 Machine Gun Cal 50 HB			145.58	126.46		
005-322-9716	M3 Tripod Mount Cal 50	101.63	73.55	78.93		121.37	99.93
005-322-9718	M2 Tripod Mount Cal 30	58.67	46.00	50.60	49.04	103.86	47.84
005-322-9727	M24A3 Gun Mount		61.00				
005-511-9042	M8C Spotting Rifle Cal 50	219.13	279.06	243.60		102.37	
005-589-1271	M14 Rifle 7.62MM	51.88	21.04	39.58	31.63	38.91	
005-602-2105	M2 Machine Gun Cal 50 HB	186.48	141.63	166.88			
005-605-7710	M60 Machine Gun 7.62MM	156.74	164.05	100.85		137.11	130.31 126.97
005-606-8412	M2 Machine Gun Cal 50			72.96	114.58	178.81	
005-670-7670	M1 Carbine Cal 30		7.33	13.79		16.94	24.85

ANNUAL AVERAGE UNIT COST (EXCLUDING UNFUNDED PARTS)
TO OVERHAUL IN FY 73 DOLLARS

FSN	NOMENCLATURE	FY 66				FY 67				FY 68				FY 69				FY 70				FY 71				FY 72			
1005-670-7675	M2 Carbine Cal 30					32.18	46.20	29.39	28.06																				30.76
1005-672-1643	M1919A4 Machine Gun Cal 30					162.67		134.90	87.47																				
1005-672-1649	M1919A6 Machine Gun Cal 30					164.87	144.55	140.82										160.59											
1005-672-1771	M3A1 Submachinegun Cal 45					27.00	23.97	33.16																					
1005-673-4750	M55 Machine Gun Mount					3150.24	3054.57	4137.52																					
1005-673-7965	M1911A1 Pistol						27.87	24.08	18.82									31.12											18.48
1005-674-1309	M1918A2 Rifle Cal 30					133.88	163.68	124.82	145.27									139.10											
1005-674-1425	M1 Rifle Cal 30					34.01	40.23																						
1005-674-1431	M1D Rifle Cal 30							195.88	184.83																				86.57
1005-678-9828	M14NN Rifle 7.62MM					135.07	146.81	360.05										129.73											123.11
1005-690-2790	M85 Machine Gun Cal 50																												191.89
1005-693-4854	M2 Machine Gun					175.16	217.54	173.53	22.08									163.09											133.88
1005-704-6650	Machine Gun Mount					52.05	66.78	55.81										62.01											63.01
1005-710-5599	M122 Mount Tripod						57.88	81.57	75.73									59.51											81.79
1005-711-5031	M49 Ring Mount						130.28	77.46										116.82											87.16
1005-716-2946	M37 Machine Gun Cal 30																	113.20											
1005-726-5636	M2 Machine Gun Cal 50 HB																												152.94

ANNUAL AVERAGE UNIT COST (EXCLUDING UNFUNDED PARTS)

FSN	NOMENCLATURE	TO OVERHAUL IN FY 73 DOLLARS						
		<u>FY 66</u>	<u>67</u>	<u>68</u>	<u>69</u>	<u>70</u>	<u>71</u>	<u>72</u>
1005-726-5687	Revolver Cal 38	31.24	26.24	47.04		31.29		
1005-726-5786	Revolver Cal 38		27.12	31.12		24.67		
1005-736-4875	AA Mount Machine Gun	255.07	195.24	253.91	111.77	185.18	193.66	
1005-834-6119	AA Mount Machine Gun	268.66	71.60	221.09	218.83			
1005-836-7286	Machine Gun Mount		119.92	101.16				
1005-840-3758	M13 Rifle Cal 22	26.91	37.75	24.94	24.78			
1005-854-4463	M142 Mount Machine Gun		81.51	42.82	52.89			
1005-869-8816	M73 Machine Gun 7.62MM			412.70	377.17		289.27	290.70
1005-890-2610	M66 Ring Mount						275.74	
1005-953-9073	M2 Armament Subsystem			848.69				
1005-957-3893	M2 Machine Gun Cal 50							
1005-973-0375	M60C Machine Gun 7.62MM	107.97	89.97	128.28	166.50			122.22
1005-999-8194	M27 Armament Subsystem							5953

FSN	NOMENCLATURE	ANNUAL AVERAGE UNIT COSTS (EXCLUDING UNFUNDED PARTS) TO OVERHAUL IN FY 73 DOLLARS						
		<u>FY 66</u>	<u>67</u>	<u>68</u>	<u>69</u>	<u>70</u>	<u>71</u>	<u>72</u>
1010-322-9737	M18 Recoilless Rifle 57MM						275.53	317.62
1010-322-9739	M18A1 Recoilless Rifle 57MM	184.18	227.00		237.62	277.86	326.04	278.14
1010-673-2006	M2 Mortar 60MM	202.70	204.23			283.772	152.64	213.32
1010-673-2010	M19 Mortar 60MM	138.66					222.39	
1010-691-1382	M79 Grenade Launcher 40MM		78.21					

**ANNUAL AVERAGE UNIT COSTS (EXCLUDING UNFUNDED PARTS)
TO OVERHAUL IN FY 73 DOLLARS**

FSN	NOMENCLATURE	FY 66					67			68			69			70			71			72		
015-073-5367	M37 Recoil Mechanism						1712.20									2644.43			2719.65			2890.86		
015-086-8164	M102 Howitzer 105MM																					8764.64		
015-099-8248	M2A5 Recoil Mechanism					949.44	1722.59		1630.12							1493.90			1647.06			1225.40		
015-099-8249	M2A4 Recoil Mechanism					1544.28	1645.79		1738.43			1270.27				1259.21			1337.79			1266.52		
015-133-8484	M40A2 Recoilless Rifle 106MM																					834.36		
015-322-9720	M30 Mortar 107MM					628.58	683.12		635.30										444.45					
015-322-9752	M101A1 Howitzer 105MM					2708.28	4309.96		4206.29										5741.11			5413.06		
015-348-4923	M40A1 Recoilless Rifle 106MM					643.32	602.68		659.18							981.01								
015-505-5285	Equilibrator					8193.80	1502.01		2215.95							1713.66								
015-511-9124	M92 Recoilless Rifle Mount								516.89							608.98								
015-657-7534	M67 Recoilless Rifle 90MM					245.31	186.01		219.29							226.21			243.85					
015-691-1289	M20 Recoilless Rifle 75MM					434.03	276.60												267.51					
015-714-1822	M1A6 Recoil Mechanism					1204.78																		
015-736-3974	M87 Mount															637.48								
015-840-1836	M29 Mortar 81MM					608.58	381.08		412.53							643.29						419.97		

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**ANNUAL AVERAGE UNIT COSTS (EXCLUDING UNFUNDED PARTS)
TO OVERHAUL IN FY 73 DOLLARS**

<u>FSN</u>	<u>NOMENCLATURE</u>	<u>67</u> <u>68</u> <u>69</u> <u>70</u> <u>71</u> <u>72</u>					
		<u>FY 66</u>					
1025-050-8922	Equilibrator	1091.00	944.55	1022.00	815.56		
1025-322-9755	M114 Howitzer 155MM	4531.00	7840.00	5889.00	10055.00		
1025-322-9768	M114A1 Howitzer 155MM	5265.00	5800.00	7113.00	12398.00	10998.00	14996.00
1025-653-7593	Equilibrator	242.22	121.91	157.44	93.10		
1025-713-3221	Equilibrator			548.64	718.36		
1025-714-8074	M6A2 Recoil Mechanism				2345.00	2497.00	2988.00
1025-863-5613	M158 Mount Assembly	3769.00	6282.00		6104.00		6520.00
1025-994-8931	M123A1 Howitzer 155MM				7083.00	9746.00	
1030-322-9788	M115 Howitzer 8 in.	18214.00	17369.00	8088.00	6308.00		8582.00
1030-714-1826	M4A1 Recoil Mechanism						5037.00
1055-840-1842	M20A1B1 Rocket Launcher 3.5 in.	82.66	93.50		59.14		
1090-933-6701	M28 Armament Subsystem						14305.00

ANNUAL AVERAGE UNIT COST (EXCLUDING UNFUNDED PARTS)
TO OVERHAUL IN FY 73 DOLLARS

FSN	NOMENCLATURE	FY 66					TO OVERHAUL IN FY 73 DOLLARS			
		67	68	69	70	71	72			
1220-344-4678	M13 Blastic Computer	466.44	426.26	395.19						
1220-448-0131	M18 Gun Direction Computer	8806.00			6766.00	6609.00				
1220-546-9715	M13A1 Blastic Computer	328.26	479.43		335.74					
1220-572-8738	M16 Computer				789.18					
1220-676-2162	M13A1D Blastic Computer	903.72	426.91		565.57	480.13	442.55			
1220-766-5137	M38 Sight Computer	418.24	1121.97	440.82						
1220-766-5139	Computer Assy	540.48		295.79	579.30	669.79				
1220-774-9445	M13A1C Ballistic Computer	179.80	382.19	328.61	413.46					
1220-856-9454	M13A2 Ballistic Computer			385.85	445.04	339.80	463.11			
1220-870-6274	M13B1C Ballistic Computer	555.90	358.25	311.70	303.25	441.02	331.18			

ANNUAL AVERAGE UNIT COST (EXCLUDING UNFUNDED PARTS)
TO OVERHAUL IN FY 73 DOLLARS

FSN	NOMENCLATURE	FY 66						70			72	
		67	68	69	70	71	72	70	71	72	71	72
1240-056-4854	Infinity Sight					117.04	91.06					
1240-076-0066	M113 Panoramic Telescope	2460.00	1831.00		808.00	837.00	879.00					
1240-300-6601	T150E1 Telescope	379.68	320.99	360.15	429.85		405.03					
1240-300-7989	M34A7 Sight Unit	207.01	173.74		141.00		174.52					
1240-344-4632	M12A7K Panoramic Telescope	154.88	181.86	150.63		169.73						
1240-344-4633	M12A7H Panoramic Telescope	202.66	184.32	226.52	146.34	192.48	171.50					
1240-344-4644	M23 Periscope	106.90	66.93		59.69		78.03					
1240-344-4645	M20A1 Periscope	148.80	241.63	180.02	127.89	174.48						
1240-344-4646	M97C Telescope	200.15	110.88	123.42								
1240-344-4654	M13 Rangefinder	996.03	886.54			953.47						
1240-344-4668	M100 Panoramic Telescope	687.31	591.44	618.33	494.70							
1240-344-4672	M93 Telescope	183.01	394.40	236.98								
1240-344-4674	M99C Telescope		490.41	488.35								
1240-346-8735	M28 Sight Periscope	133.53	148.25									
1240-360-1593	M97 Telescope	179.20	224.43	162.14	160.02	182.73						
1240-546-6339	M92D Elbow Telescope	81.54	65.57		58.29	55.41						
1240-546-9580	M20A3 Periscope	229.49	156.67	205.08	137.62	167.67	266.83					

**ANNUAL AVERAGE UNIT COST (EXCLUDING UNFUNDED PARTS)
TO OVERHAUL IN FY 73 DOLLARS**

FSN	NOMENCLATURE	FY 66					70			71		72
		67	68	69	70	71	70	71	72			
1240-601-4065	M90F Telescope	100.99	143.65	60.83	110.02							111.20
1240-608-2062	M13A1 Rangefinder	1647.00	1762.00				965.00	1184.00				
1240-654-3811	M15 Tripod Mount						24.40					
1240-657-4387	M17 Tripod Mount		76.36	113.36			67.84					94.10
1240-676-2173	M17C Rangefinder	1045.31		1735.63	771.95	1198.29		1156.09				1120.44
1240-676-2174	M31 Periscope	282.44	310.42	281.44	355.13	260.62						
1240-676-2178	M105C Telescope	336.93						350.29				
1240-676-2181	M44C Sight Infinity	51.32	65.54	54.67	49.33	52.32		56.42				50.71
1240-706-0794	M28C Sight Periscope	149.83	141.18	148.34	173.38	176.64						
1240-716-2947	Sight Reflecting	35.80	30.54	16.76		27.79						
1240-732-1469	M97H Telescope	191.75	178.32	151.02	174.05	169.55		158.46				
1240-757-9927	M4 Sight	49.51	47.24			53.15						
1240-757-9933	M1 Panoramic Telescope	153.81	107.58	206.38								
1240-757-9935	M12 Panoramic Telescope							172.60				252.10
1240-757-5975	M62 Elbow Telescope		35.44	63.17	58.41	78.44						
1240-759-7757	M15A1 Periscope	95.26	290.91	276.73	182.56							283.57

ANNUAL AVERAGE UNIT COST (EXCLUDING UNFUNDED PARTS)
TO OVERHAUL IN FY 73 DOLLARS

FSN	NOMENCLATURE	FY 66					FY 73 DOLLARS				
		67	68	69	70	71	72	73	74	75	76
1240-759-7774	M84 Telescope	45.16	46.46		35.41						
1240-759-7781	M16A1D Elbow Telescope	78.18	97.14	110.92	89.44	86.03	87.52				
1240-759-7782	M16A1E Elbow Telescope					111.08	115.75				
1240-759-7783	M16A1G Elbow Telescope						76.21				
1240-759-7852	M86F Telescope	80.66	79.45	89.75	66.89	94.94	79.29				
1240-759-7853	M90D Telescope	88.45	120.35	80.80							
1240-759-7854	M34 Sight Unit	206.55	236.23	226.52	252.34	153.94	171.79				
1240-762-9333	M19 Articulated Telescope					272.24					
1240-764-1667	M105 Articulated Telescope	444.26	248.49	265.91		240.20					
1240-764-7931	M34A1 Sight Unit	137.81	182.43	184.99		181.98					
1240-764-8288	M24CSight Unit	80.54			84.31	55.36					
1240-764-8432	M90C Telescope										80.85
1240-768-7260	M12A7C Panoramic Telescope	201.69	148.47	196.63	339.74	185.46	167.19				
1240-768-7261	M12A7D Panoramic Telescope					154.56					
1240-768-7263	M12A7F Panoramic Telescope					166.63					
1240-798-1236	M103 Telescope	42.35		72.67	68.36	77.70					

**ANNUAL AVERAGE UNIT COST (EXCLUDING UNFUNDED PARTS)
TO OVERHAUL IN FY 73 DOLLARS**

FSN	NOMENCLATURE	FY 66					
		67	68	69	70	71	72
1240-819-4519	M118 Elbow Telescope	302.05	430.51	422.63	555.33		523.13
1240-819-4520	M118C Elbow Telescope	344.00	540.55	569.48			
1240-824-3467	M62A1C Elbow Telescope	71.55	40.67		132.05	41.86	
1240-863-5642	M17B1C Rangefinder		507.20	2633.90	4357.69	1087.43	
1240-864-2930	M117 Panoramic Telescope	371.75	311.74	561.46	545.46		
1240-864-2933	M42 Periscope		47.84		43.86		56.10
1240-875-7953	M17A1 Rangefinder		799.84	1429.28	1447.54		
1240-886-5888	M72F Elbow Telescope	75.56	68.02	84.87		70.81	73.82
1240-895-9186	M115 Panoramic Telescope	370.14	461.45	2480.31	1037.15		1138.34
1240-898-6787	M116 Elbow Telescope	109.49	108.49	99.95	131.04		66.31
1240-398-6789	M116C Elbow Telescope		165.70	54.41	100.82		
1240-917-6428	M12A7Q Panoramic Telescope		247.09		169.43	156.50	141.46
1240-917-6433	M12A7S Panoramic Telescope				252.93	225.00	177.23
1240-924-5785	M103A1 Telescope		109.00		51.61	72.66	
1240-933-5630	M144A1 Periscope						1180.04
1240-963-0839	M114 Elbow Telescope		1794.44	2163.38	1219.23	397.40	
1240-974-6432	M116F Elbow Telescope				659.42	81.52	

ANNUAL AVERAGE UNIT COST (EXCLUDING UNFUNDED PARTS)
TO OVERHAUL IN FY 73 DOLLARS

FSN	NOMENCLATURE	<u>FY 66</u>	<u>67</u>	<u>68</u>	<u>69</u>	<u>70</u>	<u>71</u>	<u>72</u>
1240-974-6433	M116D Elbow Telescope						91.59	
1240-977-5586	M24 Rangefinder					1843.29		
1240-980-1745	M105D Articulate Telescope			491.12	250.64	301.38	373.41	
1240-980-9288	M32 Periscope			489.86	573.37	561.60	579.61	177.95
1240-980-9290	M34 Periscope		401.78					
1240-980-9291	M36 Periscope					602.30	484.22	
1240-990-1851	M28D Periscope					600.95	817.35	
1290-346-8184	M24 Tripod Mount	31.44	44.66	53.42	45.42	35.88		34.91
1290-652-8560	M5 Tripod Mount	44.18	58.20	47.76	54.45			24.36

ANNUAL AVERAGE UNIT COST (EXCLUDING UNFUND PARTS)
TO OVERHAUL IN FY 73 DOLLARS

FSN	NOMENCLATURE	FISCAL YEAR 1966										FISCAL YEAR 1967										FISCAL YEAR 1968										FISCAL YEAR 1969										FISCAL YEAR 1970										FISCAL YEAR 1971										FISCAL YEAR 1972									
		FY 66										67										68										69										70										71										72									
2350-049-4791	M42A1 Antiaircraft SP Artillery	30669.00										31642.00										33449.00										31846.00										23608.00																													
2350-301-8456	M48A1 Tank 90MM	36112.00										39746.00										43131.00										41734.00										47648.00										52475.00																			
2350-436-6635	M107 SP Gun 175MM																																																																						
2350-439-6242	M578 Recovery Vehicle											33988.00																																								43015.00																			
2350-439-6243	M110 SP Howitzer 8 in											45516.00																																								52515.00																			
2350-440-8810	M108 6P Howitzer 105MM	28867.00										44094.00										34750.00										41709.00																																							
2350-440-9811	M109 SP Howitzer 155MM											50433.00										38070.00										57619.00										72627.00										42304.00																			
2350-563-7966	M44A1 SP Howitzer 155MM	35213.00										30565.00										32113.00																																																	
2350-563-7967	M52A1 SP Howitzer 105MM	25941.00										25787.00										40648.00										33783.00										38084.00										35208.00																			
2350-566-4087	M41A3 Tank 76MM	34806.00										35173.00										32412.00																														32941.00																			
2350-678-5772	M88 Recovery Vehicle	33418.00										40613.00										55418.00										40558.00										44777.00										43502.00																			
2350-678-5773	M60 Tank 105MM	35083.00										62673.00																				40204.00										42324.00																													
2350-679-4812	M48A2C Tank 90MM	38689.00										56575.00										35514.00										40571.00																																							
2350-736-4202	M48 Tank 90MM	45004.00										31790.00										39439.00										33648.00																																							
2350-738-6846	M41 Tank 76MM																					32045.00																																																	
2350-739-3840	M53 Gun 155MM											63555.00										59170.00																																																	

ANNUAL AVERAGE UNIT COST (EXCLUDING UNFUNDED PARTS)
TO OVERHAUL IN FY 73 DOLLARS

FSN	NOMENCLATURE	FY 66					70			71		72	
		67	68	69	70	71	72	73	74	75	76	77	78
2350-756-8497	M60A1 Tank 105MM	30210.00	65,000.00	57442.00	36771.00	41823.00	44740.00						
2350-795-1797	M728 Engineering Vehicle						40458.00						
2350-796-8000	M42 Antiaircraft SP Artillery				28215.00	36674.00							
2350-835-8713	M51 Recovery Vehicle	73775.00	70708.00			69136.00							
2350-873-5408	M551 Armored Recon Vehicle					51245.00	48766.00						
2350-895-9154	M48A3 Tank 90MM	37650.00	36140.00	41468.00	40054.00	43517.00							

**ANNUAL AVERAGE UNIT COST (EXCLUDING UNFUNDED PARTS)
TO OVERHAUL IN FY 73 DOLLARS**

<u>FSN</u>	<u>NOMENCLATURE</u>	<u>FY 66</u>	<u>67</u>	<u>68</u>	<u>69</u>	<u>70</u>	<u>71</u>	<u>72</u>
6650-344-4647	M24 Periscope	179.32	149.49	255.94	174.86	264.09	156.64	
6650-530-0959	M15A1 Binocular					94.43		
6650-530-0960	M49 Observation Telescope	132.10	61.86			55.13		
6650-530-0973	M13A1 Binocular	121.46	103.97			99.74		99.62
6650-530-0974	M17A1 Binocular	101.44	95.67			92.70	98.72	
6650-670-2491	M3 Binocular	130.10	103.14	107.65	108.24	120.97	85.39	94.03
6650-670-2508	M13 Binocular	137.77			125.99	87.45		
6650-670-2514	M16 Binocular		59.07	89.90		92.94	121.18	112.48
6650-678-5577	M65 BC Telescope	371.04	300.96	327.88		360.56	480.03	
6650-762-9336	XM48 Periscope						514.83	645.79
6650-765-2971	M19 Periscope	160.41	222.05	273.94	169.08	227.13	130.95	
6650-788-5464	XM47 Periscope						340.16	
6650-863-5657	M18 Infrared Binocular		226.32	254.17		371.34	409.77	373.03

2. OCONUS Depot Overhaul

ANNUAL AVERAGE UNIT COST (EXCLUDING UNFUNDED PARTS)
TO OVERHAUL IN FY 73 DOLLARS

FSN	NOMENCLATURE	FY 66				
		67	68	69	70	71
						72
1015-322-9720	M30 Mortar 107 mm					1081.45
1015-322-9752	M191A1 Howitzer 105 mm					6521.19
1015-348-4923	M40A1 Recoilless Rifle					978.28
1240-360-1593	M97 Telescope				87.44	
2350-436-6635	M107 SP Gun 175 mm					25257.07
2350-439-6243	M110 SP Howitzer 8"					29404.07
2350-440-8810	M108 SP Howitzer 105 mm					27535.05
2350-440-8811	M109 SP Howitzer 155 mm					25792.96
2350-678-5772	M88 Recovery Vehicle					27917.91
2350-678-5773	M60 Tank 105 mm					36632.88
2350-756-8497	M60A1 Tank 105 mm					37524.11
2350-895-9154	M48A3 Tank 90 mm				35010.87	
6650-530-0960	M49 Observation Telescope					89.16
6650-670-2491	M3 Binocular				73.36	
6650-863-5657	M18 Infrared Binocular					225.00

APPENDIX C

INFLATION/PRICE ESCALATION INDICES

All overhaul/rebuild costs have been adjusted to FY 73 dollars by using the following indices from HQ, WECOM Cost Analysis Study, "Inflation/Price Escalation Instructions for WECOM Cost Estimating (Revised Edition No. 2)," October 1971.

<u>FY</u>	<u>Composite Ord & Accessories</u>
66	74.7
67	77.5
68	80.9
69	85.0
70	91.7
71	95.6
72	100.0
73	102.8

Example:

M105 Articulated Telescope FSN 1240-764-1667

The average cost to overhaul the M105 Telescope in FY 66 was \$322.82 in FY 66 dollars. To arrive at the FY 73 cost (\$444.76) listed for FY 66 work in Appendix B the following calculation is made.

$$\$322.82 \cdot 102.8 \div 74.7 = \$444.26$$

Therefore to escalate to FY 73 dollars, multiply the prior year cost by the FY 73 factor and divide by the prior year factor. Inversely to adjust FY 73 dollars to prior year dollars, multiply the FY 73 cost by the prior year factor and divide by the FY 73 factor.