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SECURITY ASSISTANCE REPAIR PART SUPPORT. VOLUME III. (ANNEXES B--ETC(U)
APR 77 W K GAY, W J BURKE, J H TATE

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1 OF 2

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SECURITY ASSISTANCE REPAIR PART SUPPORT

VOLUME III

AD A050756

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Prepared by
Engineer Studies Group
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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) Weapon systems in the international logistics (IL) community have increased so much that DA questioned the US ability to provide repair part support without diminishing US readiness. This study answers that question by analyzing US industrial base capabilities and the IL repair part program. It also evaluates methods of projecting military hardware system supportability. Three major conclusions are made: US industrial capability is adequate, IL repair part program management must be improved to cure problems in repair part support, and there are unexploited methods for looking ahead at military hardware system supportability. Comprehensive recommendations for improvements are made.

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SECURITY ASSISTANCE REPAIR PART SUPPORT

VOLUME III

(ANNEXES B AND C)

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LIST OF ABBREVIATIONS

AAO	authorized acquisition objective
ACSI	Assistant Chief of Staff for Intelligence
ADP	Automatic Data Processing
AGI	annual general inspections
ALMC	US Army Logistics Management Center
ALMSA	Automated Logistics Management Systems Agency
ALT	administrative leadtime
AMASM	Army Military Assistance and Sales Manual
AMD	average monthly demand
AMDEX	Army Maintenance Data Exchange System
AMDF	Army Master Data File
AOD	area oriented depot
AOQ	authorized operating quantity
APC	armored personnel carrier
APOM	Army Program Objective Memorandum
AR	Army Regulation
ARCSIP	Automated Requirement Computation System--Initial Provisioning
ARMCOM	US Army Armaments Command
ASA	Assistant Secretary of the Army
ASACG	Army Security Assistance Coordinating Group
ASAP	as soon as possible
ASD(ISA)	Assistant Secretary of Defense (International Security Affairs)
ASF	Army Stock Fund
AVSCOM	US Army Aviations Command
BLS	Bureau of Labor Statistics (US Department of Labor)
B/O	backorder
BOE	blanket open end agreement
CAA	Concepts Analysis Agency
CASA	Coordinator for Army Security Assistance
CCP	collection and consolidation point
CCSS	Commodity Command Standard System
CDS	commercial direct sales
CG	Commanding General
CIA	Central Intelligence Agency
CISIL	Central Integrated Systems International Logistics
CLRTX	Command Logistics Review Team Extended
CLSSA	Cooperative Logistics Supply Support Agreement
COA	Comptroller of the Army
COCP	customer order control point

CONUS	Continental United States
CRDD	commitment required delivery date
CSA	Chief of Staff, US Army
CSP	concurrent spare parts
DA	Department of the Army
DAAS	Defense Automatic Addressing System
DAMPL	Department of the Army Master Priority List
DARCOM	US Army Materiel Development and Readiness Command
DA STD	Department of the Army Standard
DCSLOG	Deputy Chief of Staff for Logistics
DESCOM	Depot Support Command
DIA	Defense Intelligence Agency
DIL	Director of International Logistics
DLA	Defense Logistics Agency
DOD	Department of Defense
DON	demand order number
DPPG	Defense Program Planning Guidance
DRC	see DARCOM
DRD	Demand Return and Disposal File
DSA	Defense Supply Agency
DSAA	Defense Security Assistance Agency
DSS	Direct Support System
DSU/GSU	direct support unit/general support unit
DX	direct exchange
ECOM	US Army Electronics Command[1/]
EDS	equipment distribution system
EOH	equipment on hand
EOQ	economic order quantity
EOR	Equipment Operationally Ready
ES	equipment serviceability
ESG	Engineer Studies Group
FAD	force activity designators
FMAC	Financial Management Advisory Committee
FMC	Food Machine Corporation
FMS	foreign military sales
FMSO	foreign military sales order
FORDAD	Foreign Disclosure Automated Data System
FY	fiscal year
GA	grant aid
GAO	General Accounting Office
GSA	General Services Administration

1/ ECOM was redesignated ERCOM (US Army Electronics Readiness Command) shortly after the information cut-off date for this study.

IIQ	initial issue quantity
IL	international logistics
IPD	issue priority designator
IPG	Issue Priority Group
IRO	Inventory Research Office
ITAD	Intelligence Threat Analysis Detachment
JCS	Joint Chiefs of Staff
JLC	Joint Logistics Commander
LIF	Logistic Intelligence File
LOA	letter of offer and acceptance
MAAG	Military Assistance Advisory Group
MACOM	major Army commands
MAD	Material Assistance Designator
MAP	Military Assistance Program
MICOM	US Army Missile Command[2]
MILSCAP	Military Standard Contract Administration Procedures
MILSTEP	Military Supply Transportation Evaluation Procedures
MMD	material management decision file
MRQ	maximum release quantity
MSA	maintenance support agreements
MSAP	Military Security Assistance Projection
MSC	DARCOM major subordinate command
NASA	National Aeronautics and Space Administration
NCAD	New Cumberland Army Depot
NDP	National Disclosure Policy
NICP	national inventory control point
NORM	not operationally ready maintenance
NORS	not operationally ready supply
NSN	national stock number
NSNMDR	national stock number master data record
OACSI	Office, Assistant Chief of Staff for Intelligence
OASD(ISA)	Office, Assistant Secretary of Defense (International Security Affairs)
OBRA	Office of Business Research and Analysis
OCSA	Office, Chief of Staff, US Army
ODCSLOG	Office, Deputy Chief of Staff for Logistics
ODCSOPS	Office, Deputy Chief of Staff for Operations and Plans
ODCSRDA	Office of the Deputy Chief of Staff for Research, Development, and Acquisition
OMA	operation and maintenance, Army
OP Code	ownership purpose code

2/ MICOM was redesignated MIRCOM (US Army Missile Readiness Command) shortly after the information cut-off date for this report.

PAA	Procurement Appropriations, Army
P&B	price and budgeting
PCF	program change factor
PCLTR	procurement cycle leadtime requirement
PCR	procurement cycle requirement
PDF	program data file
PEMA	procurement of equipment and missiles, Army
PLT	production leadtime
PM	project manager
POC	point of contact
POD	point of debarkation
POE	point of embarkation
POM	Program Objective Memorandum
P&P	procurement and production
PPBS	Planning, Programming, and Budgeting System
PROMS	Procurement Management System
PROT-IPD-H	protected for issue priority designators--high
PROT-IPD-L	protected for issue priority designators--low
PWD	procurement work directive
PWRMO	protectable war reserve material objective
RAM-D	reliability, availability, maintainability, and dependability
RCS	report control symbol
RCYR	repair cycle requirement
RDD	required delivery date
RDES	requirements determination and execution system
RDT	requirements determination time
RDTE	research, development, test, and evaluation
RDTR	requirements determination time requirement
RECAP	Review and Command Assessment of Programs
REOR-PT	reorder point
RO	requirements objective
ROID	Report of Item Discrepancy
SA	Secretary of the Army
SAMPAP	Security Assistance Master Planning and Phasing Worksheets
SCR	system change request
SECDEF	Secretary of Defense
SIC	Standard Industry Classification
SIMS-X	Selected Item Management System Extended
SL	safety level
SLAC	support list allowance card
SMGC	supply management grouping codes
SMGD	supply management grouping designators
SSA	see CLSSA

TARCOM	US Army Tank and Automotive Readiness Command
TROSCOM	US Army Troop Support Command
UMMIPS	Uniform Military Materiel Issue Priority System
UPZ	(foreign military sales contract designator for Jordan HAWK sale in 1976)
US	United States
USAAA	US Army Audit Agency
USAF	US Air Force
USAILCOM	US Army International Logistics Command
USAREUR	United States Army, Europe
VSL	variable safety level
WFO	Washington Field Office
WLRR	wholesale level replenishment requirement

ANNEX B

WEAPON SYSTEM SUPPORTABILITY

ANNEX B

WEAPON SYSTEM SUPPORTABILITY

I. INTRODUCTION

1. Purpose. This annex:

a. Evaluates the adequacy of US industrial base capability to satisfy total supply system repair part requirements (i.e., US and IL).

b. Identifies causes of misconceptions concerning US industrial base inadequacy.

c. Identifies existing management tools capable of looking ahead of weapon system supportability.

2. Scope. This annex:

a. Presents specific repair part tests and a general US industrial sector trend analysis to evaluate the overall capability of the US industrial base to satisfy total US supply system repair part requirements in the FY 77-81 time frame.

b. Presents specific examples of procurement and production issues to identify how general misconceptions of US industrial base inadequacy develop.

c. Describes and evaluates the MICOM Visibility program, DARCOM system assessment letters, and DARCOM Review and Command Assessment of Programs (RECAP) as potential methods for looking ahead at weapon system supportability.

3. Methodology.

a. This annex extends Annex A conceptual discussions into real-world situations by presenting actual numerical comparisons and narrative examples of US industrial base capabilities based on MSC records.

Findings and conclusions thus developed were tested for validity by conducting a separate analysis of US industrial sector trends based on US Department of Commerce data.

b. Numerical examples are based on a carefully selected group of repair parts. Although not a pure statistical sample, these repair parts are considered illustrative of the total US supply system environment. In each case, MSC prepared a list of repair parts which were all weapon systems peculiar, operationally essential, US Army-managed repair parts. This list represented repair parts considered significantly important to US Army readiness and for which adequate information could be obtained to perform discrete supply requirements versus production capability tests. Final selection occurred during an iterative interview process with MSC representatives from project managers' offices and production and procurement and material management directorates. This sample creates a profile of several industrial sectors and supply management considerations. Figure B-1 lists the selected repair parts with some profile data. Figure B-2 stratifies the repair parts by constraints/issues. Figure B-3 presents the spare parts stratified by MSC.

c. Narrative examples of production and procurement issues were selected during interviews with MSC personnel. Each example was analyzed to illustrate the delicately balanced material management process.

SELECTED REPAIR PARTS LIST

System	NSN	Nomenclature	Unit Price ($)	Funding ASF	Funding PAA	Mgmt Intensity	Repar-able	Current Supply Status a/	Reason for Selection
VRC-12	5820-00-087-0061	A1000 Module	97.0	--	X	High	X	Sick	Small Business
	5820-00-089-0911	Guard Assy	12.0	X	--	High	--	Well	Fabrication
	5820-00-437-2353	Ant Tip Assy	1.0	X	--	Medium	--	Sick	Process
	5820-00-853-5915	A20000 Module	77.0	X	--	High	X	Well	Demand
	5820-00-853-5917	A1200 Module	18.0	--	X	High	X	Well	Contract
	5820-00-856-2730	AT1096 Ant Sub Assy	24.0	X	--	Medium	X	Sick	Contract
	5820-00-878-4608	A6000 Module	71.0	--	X	High	X	Well	Specifications
	5820-00-884-2475	A8400 Module	29.0	--	X	High	X	Well	Depot Requirements
	5820-00-884-2479	A8100 Module	23.0	--	X	High	X	Well	Ingredients
	5820-00-892-3339	C2298 Control	162.0	X	--	Medium	X	Sick	Depot Requirements
	5820-00-892-3342	AM 1780 Amp	407.0	X	--	High	X	Sick	Depot Requirements
	5820-00-995-8687	A1000 Module	148.0	--	X	High	X	Sick	Buy American
	5914-00-431-6718	Trans Suppressor	338.0	X	--	High	X	Sick	Funding
	5960-00-892-3808	Elect Tube	34.0	X	--	High	X	Well	Split Responsibility
	5985-00-985-9024	AS1729 Antenna	160.0	X	--	Medium	X	Well	Funding Type
	5995-00-823-2827	Cable Assy	14.0	X	--	Medium	--	Well	Return
M-113	2520-00-572-8605	Trans Gear Case	1,720.0	--	X	High	X	Sick	Ingredients
	2520-00-698-8382	Sprocket, Final Drive	163.0	X	--	High	--	Sick	Bankruptcy
	2920-00-981-4936	Starter, Generator	2.0	X	--	High	X	Well	Split Responsibility
	2930-00-168-4896	Radiator	893.0	X	--	High	--	Well	Specifications
	3020-00-141-1154	Sprocket	300.0	X	--	High	--	Sick	Process
	3020-00-572-8717	Gear	32.0	X	--	Medium	--	Sick	Bankruptcy
	3020-00-866-9373	Gear	71.0	X	--	Medium	--	Sick	Process

a/ "Sick" indicates the part will be in backorder status at some time in the next 90 days.

(Figure B-1 Continued on Next Page)

SELECTED REPAIR PARTS LIST--Continued

System	NSN	Nomenclature	Unit Price ($)	Funding		Mgmt Intensity	Repar-able	Current Supply Status	Reason for Selection
				ASF	PAA				
M60	2520-00-692-5026	Gear Set	579.0	X	--	Very High	--	Well	Process
	2520-00-753-9886	Carrier	182.0	X	--	High	--	Well	Small Business
	2530-00-701-3976	Wheel	149.0	X	--	Very High	X	Well	Process
	2530-00-784-9292	Wheel	165.0	X	--	Very High	X	Well	Technology
	2851-00-856-9005	Engine	33,621.0	--	X	Very High	X	Well	Sole Source
	2920-00-088-3989	Regulator	321.0	X	--	Very High	--	Well	Specifications
	2920-00-830-6660	Generator	1,110.0	X	--	High	X	Well	Process
	2940-00-070-1112	Filter	120.0	X	--	High	--	Well	Sole Source
	2950-00-397-3385	Turbo	655.0	X	--	High	X	Sick	Technology
	3020-00-252-5637	Sprocket	174.0	X	--	High	--	Well	Sole Source
	4140-00-162-2615	Blower	80.0	X	--	Medium	X	Well	Specifications
HAWK	1430-00-155-8288	Sim Center	11,087.0	--	X	High	X	Sick	Depot
	1430-00-433-9137	Printer Wiring	48.0	X	--	Low	--	Well	Technology
	1430-00-451-1054	Electric Comp	236.0	--	X	High	X	Well	Technology
	1430-00-491-6943	Amp Int Freq	3,745.0	--	X	High	X	Sick	Depot
	1430-00-491-6945	Circuit Card Assy	2,903.0	--	X	High	X	Well	Forecast
	1430-00-484-7998	Control Radar Set	8,443.0	--	X	High	X	Sick	Return
	1430-00-493-9118	Electric Comp	698.0	--	X	Medium	X	Sick	Depot
	1430-00-626-8315	Amp-Conventional	8,315.0	--	X	Medium	X	Well	Technology
	1440-00-316-0179	Stud Retaining	5.0	X	--	Medium	--	Sick	Forecast
	1440-00-394-9792	Tube, Telescope	751.0	X	--	Low	--	Sick	Forecast

(Figure B-1 Continued on Next Page)

SELECTED REPAIR PARTS LIST--Continued

System	NSN	Nomenclature	Unit Price ($)	Funding ASF	Funding PAA	Mgmt Intensity	Repar-able	Current Supply Status	Reason for Selection
	1440-00-480-7589	Amp, Audio	158.0	--	X	Medium	X	Well	Leadtime
	1440-00-481-2798	Cable Assy	345.0	X	--	Medium	X	Well	Funding
	1440-00-481-2800	Cable Assy	316.0	X	--	Low	--	Well	Funding
	5830-00-566-1475	Intercommunication	711.0	--	X	High	X	Sick	Contract
	5915-00-433-9149	Filter, High Pass	424.0	--	X	Medium	X	Sick	Leadtime
TOW	1430-00-147-2092	Missile Guidance	12,187.0	--	X	Very High	X	Well	Repair
	1430-00-464-1070	Circuit Card	1,380.0	--	X	Very High	X	Well	Delivery
	1440-00-140-1529	Sight, Optical	13,119.0	--	X	High	X	Sick	Contract
	1440-00-140-9836	Elec Pre Amp	1,434.0	--	X	High	X	Sick	Leadtime
	1440-00-455-5905	Traversing Unit	5,673.0	--	X	Very High	X	Sick	Repair
	1440-00-455-9406	Tracker Assy	3,348.0	--	X	High	X	Sick	Repair
	1440-00-455-9415	Sensor Assy	922.0	--	X	High	X	Sick	Repair
	1440-00-462-2553	Damper, Azimuth	1,95[illegible].0	--	X	High	X	Sick	Leadtime
	1440-00-462-2728	Cable Assy	250.0	--	X	High	X	Sick	Leadtime
	1440-00-522-0182	DC Regulator Assy	82.0	--	X	High	X	Sick	Fabrication
	1440-00-723-7329	Electronic Modulator	184.0	--	X	High	X	Sick	Depot
	6130-00-538-0407	Power Supply	821.0	--	X	High	X	Sick	Leadtime
	6140-00-454-8261	Batt Assy Storage	538.0	--	X	Very High	X	Sick	Leadtime
	6650-00-400-7621	Prism, Boresight	1,976.0	--	X	High	X	Sick	Leadtime

Figure B-1

REPAIR PARTS STRATIFICATION

Affected Participant	Constraints/Issues	No. of Parts
Producer	Ingredients	2
	Process	6
	Contract	4
	Technology	5
	Bankruptcy	2
Procurer	Small Business	2
	Split Supply Responsibility	2
	Funding Type	2
	Depot Fabrication	2
	Specifications	4
	Sole Source	2
	Buy American	1
	Capacity	1
	Leadtime	8
User	Depot Requirements	7
	High Demand	2
	Funding Limits	2
	Repair/Return	6
	Forecast	3
	Total	63

Figure B-2

REPAIR PARTS BY MSC

MSC	Weapon System	Parts Tested
ECOM	AN/VRC-12 Radio	16
MICOM	I-HAWK	15
	TOW	14
TARCOM	M113	7
	M60	11
Total		63

Figure B-3

II. REQUIREMENTS VERSUS CAPABILITIES

4. Specific Tests.

a. A worst-case estimate of future total US supply system repair part peacetime requirements (i.e., US and IL) was developed for each part and compared to the expected US industrial base capability to provide the part (see Appendix B-1). Future repair part requirements were estimated by inflating CCSS historical and forecasted IL and US equipment demand data based on expected increases (PCF) in inventories during the FY 77-81 time frame. All requirements data were subjectively reviewed and biased towards a worst-case situation. Current and future capabilities data were obtained from MSC procurement history files. Current capability was defined as the production/overhaul capacity of contractors presently under US Army contracts. Future capacity is based on the total capacity of producers who have or can be expected to bid on the item. Information on minimum capability a contractor would maintain was not available. Also, procurement records did not stratify contractor information in terms of new production and overhaul capability. However, based on MSC procurement and production (P&P) representative comments, it was assumed unused new production capability would be available to overhaul parts if required. Every effort was made to delete contractors producing parts for end item production from the production capacity total.

b. US industrial capability far surpassed the maximum expected requirement in every case (see Figure B-4). This gives credibility to

FUTURE REQUIREMENTS AND PRODUCTION CAPABILITY

			Procurement Leadtime Rqr (Months)		Future Maximum Estimated Yearly Demand				Maximum Yearly Production Capability	
						Nonrecur				
System	NSN	Nomenclature	ALT	PLT	Recur	US	IL	Total	Current	Future
VRC-12	5820-00-087-0061	A1000 Module	4.5	11.0	182	166	52	400	8,400	16,800
	5820-00-089-0911	Guard Assy	3.0	9.0	838	285	--	1,123	6,000	18,000
	5820-00-437-2353	Ant Tip Assy	4.5	4.0	64,800	5,881	--	70,681	72,000	120,000
	5820-00-853-5915	A2000 Module	1.0	10.0	3,160	892	5	4,057	7,800	19,200
	5820-00-853-5917	A1200 Module	4.5	7.0	2,695	594	10	3,299	3,600	12,000
	5820-00-856-2730	AT1096 Ant Sub Assy	5.5	10.0	4,071	160	10	4,241	6,000	18,000
	5820-00-878-4608	A6000 Module	2.5	8.0	215	84	11	310	3,600	8,400
	5820-00-884-2475	A8400 Module	4.5	9.0	331	1,042	432	1,805	1,200	3,600
	5820-00-884-2479	A8100 Module	2.5	10.0	211	775	411	1,397	3,000	6,000
	5820-00-892-3339	C2298 Control	5.0	11.0	515	6,516	2	7,033	20,400	756,000
	5820-00-892-3342	AM 1780 Amp	6.0	15.0	195	4,158	13	4,366	4,800	10,800
	5820-00-995-8687	Power Supply Module	1.5	8.0	1,265	253	793	16,115	4,800	16,200
	5915-00-431-6718	Trans Suppressor	5.0	11.0	200	14,894	33	15,127	2,400	21,600
	5960-00-892-3808	Elect Tube	4.5	9.0	4,859	645	666	6,170	12,000	36,000
	5985-00-985-9024	AS1729 Antenna	5.0	15.0	226	26,083	61	26,370	18,000	84,000
	5995-00-823-2827	Cable Assy	3.2	11.0	389	135	11	535	1,200	8,400
M-113	2520-00-572-8605	Trans Gear Case	3.0	22.0	252	33	--	285	3,600	3,600
	2520-00-698-8382	Sprocket, Final Drive	6.0	12.0	2,044	66	--	2,110	2,400	7,200
	2920-00-981-4936	Starter, Generator	4.7	8.8	547	214	--	761	2,400	2,400
	2930-00-168-4896	Radiator	12.0	16.5	1,576	140	--	1,716	7,200	14,400
	3020-00-141-1154	Sprocket	5.6	11.3	11,348	2,548	--	13,896	18,000	36,000
	3020-00-572-8717	Gear	6.0	31.0	257	553	--	810	12,000	36,000
	3020-00-866-9373	Gear	4.0	18.0	145	329	--	474	12,000	36,000

(Figure B-4 Continued on Next Page)

FUTURE REQUIREMENTS AND PRODUCTION CAPABILITY--Continued

			Procurement Leadtime Rqr (Months)		Future Maximum Estimated Yearly Demand				Maximum Yearly Production Capability	
						Nonrecur				
System	NSN	Nomenclature	ALT	PLT	Recur	US	IL	Total	Current	Future
M60	2520-00-692-5026	Gear Set	6.0	12.0	999	124	--	1,123	4,320	4,320
	2520-00-753-9886	Carrier	4.0	14.0	56	63	--	119	120	160
	2530-00-701-3976	Wheel	6.0	12.0	7,122	1,329	631	9,082	60,000	84,000
	2530-00-784-9292	Wheel	3.0	8.0	9,022	879	21	9,922	48,000	96,000
	2851-00-856-9005	Engine	4.0	13.0	892	6	--	898	3,000	4,200
	2920-00-088-3989	Regulator	4.0	8.0	1,681	133	5	1,819	4,200	--
	2920-00-830-6660	Generator	3.0	9.0	1,625	80	--	1,705	7,200	10,800
	2940-00-070-1112	Filter	4.0	8.0	2,042	8	2	2,052	14,400	28,400
	2950-00-397-3385	Turbo	5.0	11.0	401	41	--	442	4,800	4,800
	3020-00-252-5637	Sprocket	3.0	12.0	7,068	639	123	7,830	6,000	18,000
	4140-00-162-2615	Blower	3.0	14.0	2,353	59	11	2,423	6,600	6,600
HAWK	1430-00-155-8288	Sim Center	3.0	19.0	21	70	167	258	120	2,400
	1430-00-433-9137	Printer Wiring	3.0	6.0	29	25	142	196	24,000	Unlmt[a/]
	1430-00-451-1054	Electric Comp	3.0	18.0	243	103	166	512	3,600	Unlmt
	1430-00-491-6943	Amp Int Freq	3.2	16.0	193	33	142	368	120	240[b/]
	1430-00-491-6945	Circuit Card Assy	3.2	23.0	19	37	202	258	480	Unlmt
	1430-00-484-7998	Control Radar Set	3.0	29.0	34	44	80	158	120	2,400
	1430-00-493-9118	Electric Comp	3.0	12.0	16	37	195	248	120	Unlmt
	1430-00-626-8315	Amp-Conventional	4.0	32.0	80	10	5	95	240	Unlmt
	1440-00-316-0179	Stud Retaining	1.2	6.0	179	7	211	397	19,200	Unlmt
	1440-00-394-9792	Tube, Telescope	3.2	11.0	15	19	4	38	480	Unlmt
	1440-00-480-7589	Amp, Audio	3.0	23.0	293	119	89	501	12,000	Unlmt
	1440-00-481-2798	Cable Assy	4.2	11.0	31	12	24	61	4,800	24,000
	1440-00-481-2800	Cable Assy	3.0	13.0	21	16	122	159	7,200	Unlmt
	5830-00-566-1475	Intercommunicate	4.0	6.0	152	73	157	382	4,800	100,000
	5915-00-433-9149	Filter, High Pass	6.2	19.0	77	21	65	163	6,000	Unlmt

(Figure B-4 Continued on Next Page)

FUTURE REQUIREMENTS AND PRODUCTION CAPABILITY--Continued

System	NSN	Nomenclature	Procurement Leadtime Rqr (Months)		Future Maximum Estimated Yearly Demand				Maximum Yearly Production Capability	
						Nonrecur				
			ALT	PLT	Recur	US	IL	Total	Current	Future
TOW	1430-00-147-2092	Missile Guidance	3.0	16.0	23	49	5	77	240	Unlmt
	1430-00-464-1070	Circuit Card	3.0	21.0	28	51	24	103	1,200	Unlmt
	1440-00-140-1529	Sight, Optical	3.0	18.0	68	181	5	254	4,800	22,600
	1440-00-140-9836	Elec Pre Amp	3.0	17.0	23	112	55	190	Unlmt	22,600
	1440-00-455-5905	Traversing Unit	3.0	19.0	9	44	19	72	4,800	36,000
	1440-00-455-9406	Tracker Assy	3.0	17.0	17	84	--	101	4,800	36,000
	1440-00-455-9415	Sensor Assy	3.0	16.0	19	82	--	101	4,800	19,200
	1440-00-462-2553	Damper, Azimuth	3.0	16.0	17	5	7	29	9,000	45,000
	1440-00-462-2728	Cable Assy	3.0	9.0	75	18	--	93	Unlmt	Unlmt
	1440-00-522-0182	DC Regulator Assy	1.0	16.0	33	20	--	53	Unlmt	Unlmt
	1440-00-723-7329	Electronic Modulator	3.0	9.0	24	88	--	112	Unlmt	Unlmt
	6130-00-538-0407	Power Supply	6.0	18.0	33	92	97	222	2,400	Unlmt
	6140-00-454-8261	Batt Assy Storage	3.0	14.0	50	161	--	211	19,200	38,400
	6650-00-400-7621	Prism, Boresight	3.0	17.0	15	95	5	115	2,400	2,400

a/ "Unlimited" production capability is the term used by MICOM to describe the case where the number of producers for an item exceeds 100.

b/ Demand rates for this part are extremely high considering its $7,000-11,000 unit cost. MICOM initiated action to evaluate part engineering reliability and to reassess production capability. A 406 growing to 783 annual overhaul demand is also expected. Present depot overhaul capacity is 540 units annually. MICOM expects no problems increasing new production and overhaul capabilities to meet these future demands because of the lead-time available before they occur.

Figure B-4

claims by MSC P&P Directorate personnel that if a full requirement is known on time, it can be obtained. In fact, potential US repair part production capability is so large, even doubling US requirements to support huge US inventory increases under a division restructuring program could be absorbed in most cases (i.e., assuming end items could be produced) without US industry changing its operational pattern.

5. General Test.

a. The industry appraisal is an independent evaluation of the US industrial base capability to satisfy US supply system repair parts requirements in the FY 77-81 time frame. This general overview analyzed 19 selected US industrial sectors which produce items critical to the US Army. The primary sources of data dealing with these 19 industrial sectors were industrial analysts in the Departments of Commerce and Labor who monitor over 500 sectors, each possessing a unique Standard Industry Classification (SIC) code. Four indicators (value of production, employment, producing units, and capital investment) were used to identify problems and historical trends. This historical information provided the basis for the Department of Commerce projection of the value of products shipped through 1985. The information on problems and historical and future trends is aggregated and an overall evaluation of the adequacy of the industrial base is made.

b. This analysis identified a number of problems which impact on the present adequacy of the industrial base. For example, DOD's share of total production has decreased from the high reached during the Vietnam War, and employment has experienced significant fluctuations resulting from labor unrest and changing technology. Stresses generated within the US economy or foreign economies have combined to shift the pattern of production in several industrial sectors. Within the US, the shift has been due to increased demand from nondefense sectors (e.g., general aviation, calculators). Sources of external stress include Japan and countries of the Middle East. Competition from Japan has lowered some US profit margins while Middle East customers have amplified US demands for sophisticated technology (communications/electronics, guided missiles/aerospace). However, the final analysis shows that industrial capacity in these and in all other sectors is increasing and will continue to be more than adequate. This optimistic projection could be affected by a technological breakthrough, a shortage of raw material (e.g., petroleum), or effects caused by continued inflation and unemployment.

6. Overall Capability Evaluation. The blend of specific and general level analyses validates the adequacy of US industrial sectors reviewed to satisfy total US supply system repair part requirements. It may, however, be too optimistic to extrapolate this initial conclusion into a statement that all weapon systems are totally supportable. Exceptions may exist. However, this initial conclusion strongly indicates forward-looking supply management could prevent adverse supply system impacts from industrial base problems.

III. MISCONCEPTIONS

7. Why?

a. Misconceptions of US industrial base inadequacy are usually traceable to a misinterpretation of some aspects of the intricate, delicately balanced material management process. Process parameters include timing, requirements and budget forecasting, procurement, and production.

b. Economic considerations incorporated into the US supply system force it to operate on the "lean" side (see Appendix A-1). Thus, any inaccuracy during requirements computations could cause short supply situations. Inaccuracies are not uncommon considering requirements are forecasted and funded using average demands, average inventory changes, representative leadtime increments, estimated depot maintenance factors, and representative unit prices. If policies, procedures, and functional responsibilities for requirements determination are not adequate--as is the case for IL programs--short supply situations inevitably occur. This often causes misconceptions of industrial base inadequacies. The "perceived" inadequacy is actually the result of a failure to fund a requirement at the right time.

c. The most common misconception of industrial base inadequacy involves misinterpretations of the authorized acquisition objective (AAO). Although not directly related to repair parts production capability, this example well sets the stage for other examples.

(1) The AAO identifies the total weapon system quantity the US plans to procure. A recent GAO report questioned the prudence of selling a particular combat vehicle to foreign customers when only 50 percent of the US AAO was on hand. The question implied US industrial base inadequacies caused the 50 percent AAO shortfall. (133)[1/]

(2) The AAO is viewed differently by ODCSOPS, ODCSLOG, and ODCSRDA (see Figure B-5). ODCSRDA views the AAO simply as a procurement goal. Thus, it fills the AAO "standpipe" from the bottom up. ODCSRDA, within PPBS, programs procurement quantities that can reasonably be funded and are reasonably in phase with ODCSOPS and ODCSLOG plans. Only the production capability ODCSRDA cannot use is offered to FMS customers. US producers establish production lines to economically produce these programed quantities. Sudden changes usually cannot be absorbed.

(3) ODCSOPS stratifies the AAO into priority groups based on threats and missions. Thus, the issue priority assigned to a war reserve stock in USAREUR may be higher than an Active force line unit elsewhere in the world. ODCSLOG must finally juggle ODCSRDA asset delivery schedules and ODCSOPS-issue priority lists to gradually fill each customer account. Therefore, with 50 percent AAO on hand, strategically important US units may have 100 percent of their authorized issue.

(4) The preceding explanation dispels misconceptions of industrial base inadequacy. It identifies economic considerations and

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1/ Numbers in parentheses refer to bibliographic references in Annex C, Volume III.

AAO COMPARISON

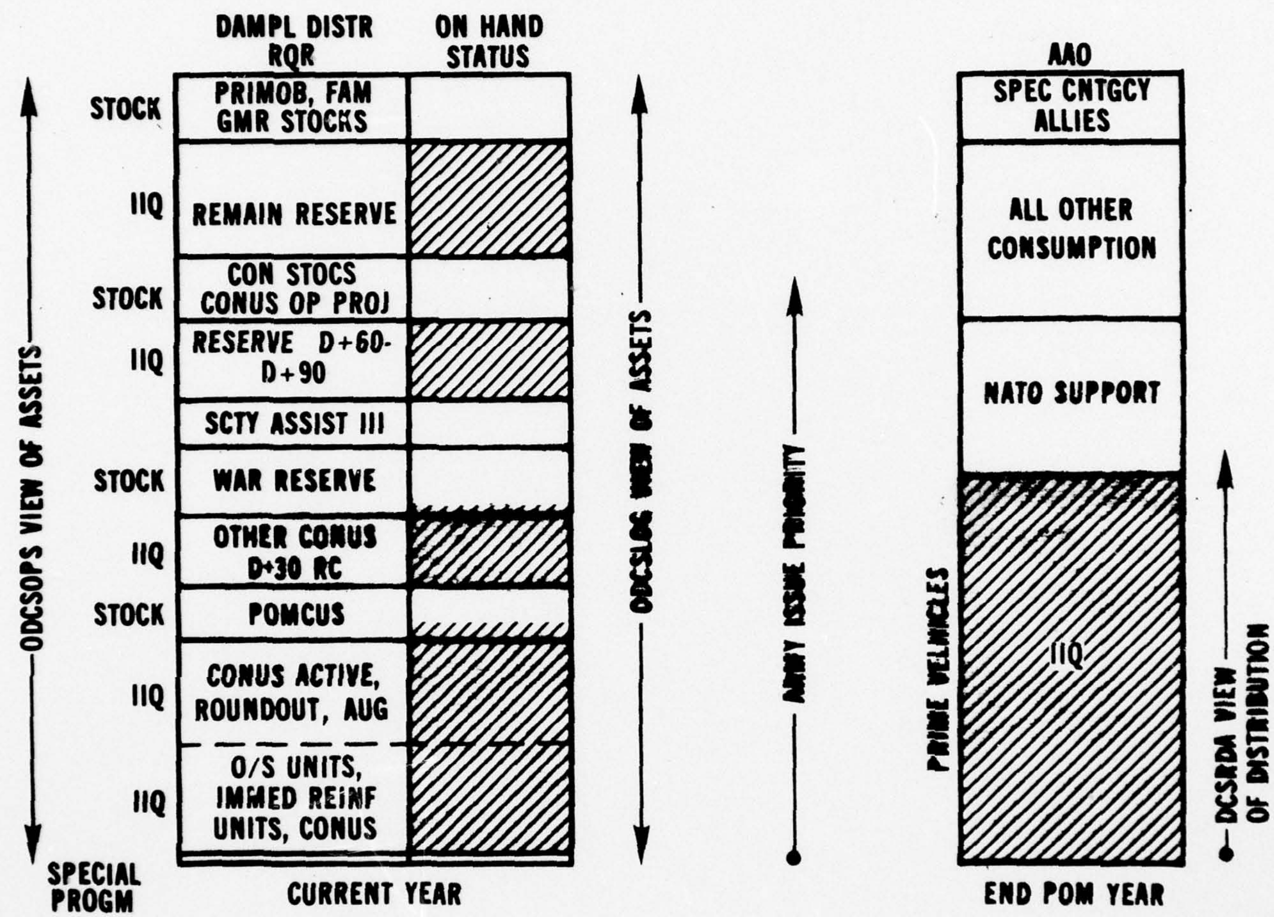


Figure B-5

other conscious US Army management decisions that provided the input on which US industry designed their production restraints. A representative from Material Management Division, Directorate for Supply and Maintenance, ODCSLOG developed this informative AAO explanation in conjunction with work on the very comprehensive ODCSLOG equipment distribution system (EDS) designed to help ODCSLOG distribute AAO assets.

d. Sources of industrial base inadequacy misconceptions pertaining to repair part production are illustrated in following paragraphs. Each example discusses the situation, corrective action, US supply system impact, and IL implications. Note the intricate relationship between producers, procurers, and users. The manager must monitor these relationships to ensure that potential production capacity is exploited at the right time.

8. <u>Production Issues</u>.

a. Ingredients.

(1) Raw material.

(a) Situation. Producers of germanium (used in AN/VRC-12 module transistors) discontinued germanium production and shifted to production of silicon, a better product. There will be no difficulty obtaining adequate silicon.

(b) Corrective action. After being notified of the production change, the US procured a 5-year supply of germanium to ensure continued production of current modules. In addition, specifications to use silicon in future production are being developed.

(c) US supply system impacts. Short supply may occur if the forecasted demand is exceeded or the drafting of new specifications is delayed. New leadtimes and costs must be considered in requirements and budget forecasts.

(d) IL impacts. The US should assess the impact of each new IL sale to prevent premature drawdown of germanium stocks. Good total support program procedures would have ensured IL demands were properly included in final US buy.

(2) Major assembly components.

(a) Situation. Three independent events placed the M113 transfer gear in short supply. These are the diversion of specialty metals to support sudden increases in tank production, environmental legislation forcing many smaller casting and forging producers out of business, and the bankruptcy by the producer of a high-quality gear used in the gear case disrupted delivery of 1,000 gears. Delivery leadtime eventually jumped from 8 to 29 months. The October 1976 GAO FMS report (133) identified this gear case shortage as a victim of industrial base inadequacy. GAO did not uncover the causes of this superficial production restraint.

(b) Corrective action. The US negotiated a premium price contract for more gear cases with the prime contractor. The contract stipulated the prime contractor would develop additional gear sources. Based on US demand, the prime contractor made additional capital investments and increased production.

(c) US supply system impacts. An unexpected increase in leadtimes and contract costs invalidated requirement and budget forecasts and a short supply resulted.

(d) IL implications. The failure to include leadtime and replacement price considerations in IL cases during this period aggravated the US supply situation. Direct vendor-customer shipment would have reduced IL competition for meager US stocks.

b. Process.

(1) Quality control.

(a) Situation. A plastic AN/VRC-12 antenna top assembly was designed to prevent personal injuries. The bond between the ultrasonically welded components frequently failed.

(b) Corrective action. Reacting to sudden increased demand patterns, MSC directorates working together identified the problem as inadequate inspection and testing at the plant. Corrections were made.

(c) US supply sytem impacts. Unexpected high demands invalidated requirements and budget forecasts.

(d) IL implications. IL demands would have aggravated but not caused this situation.

(2) Inadequate specifications.

(a) Situation. An M60 final-drive gear set required a special metal-hardening process. The part had a high failure rate.

The MSC found inadequate US specifications permitted production of the inferior part.

(b) Corrective action. Improved specifications were developed to address the quality problem. In addition, a second producer was qualified to provide increased production.

(c) US supply system impact. Several iterations were necessary to improve the specifications. During this time, requirement and budgeting forecasts were subjected to turbulence.

(d) IL implications. IL causes 20 percent of the total demand for this part. This probably reflects IL dependence on the US for highly technical processes. More accurate CRDD determinations and a direct delivery policy would have reduced additional turbulence caused by IL. On the other hand, the high IL demand probably helped the US interest another producer.

c. Contract disputes.

(1) Situation. An AN/VRC-12 antenna assembly plastic pin failed frequently. Demand rates exceeded 600 per month. Specifications for a metal pin were developed and a contract was let. Several producers bid for the contract. The contract winner failed to perform, claiming he had underbid and requested a new contract or termination of the existing contract.

(2) Corrective actions. The MSC sued for specific performance. Another contract was let.

(3) US supply system impact. Contractor nonperformance caused short supply. The additional contract required additional funds, thus invalidating MSC budget forecasts.

(4) IL implications. A large asset release was made to Norway prior to the producer problem. The shipment was made anticipating new deliveries would occur as scheduled. This situation created the impression of IL taking US assets. A direct delivery policy would have left the US with the assets and transferred the risk to the IL customer.

d. Technology.

(1) Situation. A new M60 turbocharger is being fielded as a product improvement action. The previous turbocharger was reparable. The producer of components needed to repair the old item will not produce them, claiming to have retooled for the new item. Thus, demands for the new items will surge.

(2) Corrective action. The MSC is trying to determine how to arrange for faster delivery of the new item or develop another method of repairing the old item.

(3) US supply system impact. Requirements and budget forecasts for this part have been invalidated. This may constrain MSC ability to buy other parts.

(4) IL implications. Considering the small number of IL demands for this item, the MSC should be able to prevent IL from aggravating this situation if the MSC IL directorate is included in corrective action planning.

9. Procurement Issues.

a. Small business.

(1) Situation. A small business contract for over 1,900 VRC-12 receiver-amplifiers was let but no deliveries were made.

(2) Corrective action. The ECOM procurement office requested an inspection of the producer's operation to determine reasons for the delinquency. The inspection team recommended the producer be allowed to meet an adjusted delivery schedule. In the event of failure, the team recommended termination. ECOM then let a contract to the prime contractor to provide a supply of these items.

(3) Impact on US supply system. The production base and the demand forecast were adequate. The problem was caused by the legal requirement to utilize small business firms. MSC requirement and budget forecasts were subjected to considerable turbulence.

(4) IL implication. A direct delivery policy would have prevented IL nonrecurring demands from aggravating this situation.

b. Split responsibility.

(1) Centralized procurement.

(a) Situation. A consummable AN/VRC-12 electronic tube is the 25th most demanded ECOM-managed part. Procurement responsibility for the part rests with the Defense Electronics Supply Center (DESC). ECOM submits a military interdepartmental procurement request (MIPIR) to DESC when procurement is necessary. Split management responsibility is a result of the dynamic nature of the supply system. As efforts to centralize and streamline supply functions continue, arrangements similar to this will increase.

(b) Corrective action. To prevent supply problems, this item is given a high management intensity designator and receives special attention.

(c) US supply system impacts. Any procurement delays would cause short supply of this fast-moving item.

(d) IL implications. Any inaccuracy in preparing an IL contract would also quickly cause short supply of this item.

(2) Inter-MSC support.

(a) Situation. An M113 starter generator is supplied by a subcontractor to Food Machine Corporation (FMC) for end item production. The subcontractor's operation is dependent on timely receipt of a government-furnished component. TARCOM orders this component through TROSCOM. TROSCOM awarded a contract for the government-furnished component to a third contractor who became delinquent in deliveries. Several lawsuits resulted.

(b) Corrective action. Repair part assets were diverted to fill the government-furnished component requirement. They were "paid back" when the TROSCOM producer made deliveries.

(c) US supply system impacts. Assets for repair part customers were constrained to prevent expensive production delays. Considerable teamwork was required to solve this problem.

(d) IL impacts. IL demands for this item are high, reflecting the IL dependency on specialized US items. Accurate CRDD determinations would prevent IL aggravation of these situations.

c. Funding.

(1) Situation. An electrical transient suppressor is used on all tracked vehicles with AN/VRC-12 radios. Originally this item was PAA funded. Due to constrained funding, the part fell into short supply. It was switched to ASF funding. However, at this time the short supply position was aggravated by increased combat vehicle production rates and small business procurement problems.

(2) Corrective action. Several material management and expedited procurement actions were needed to obtain adequate assets.

(3) US supply system impact. Considerable supply turbulence was encountered while actions were underway to make this item well.

(4) IL implications. Careful CRDD determinations and a direct delivery policy would dampen IL aggravation of this situation.

d. Performance specifications.

(1) Situation. Performance specifications for an M60 regulator are readily met by an unlimited number of electrical contractors. Internal configurations are developed by the producer to meet the specified outside configuration. Problems to date are dimensional, not functional.

(2) Corrective action. Three producers are qualified to supply this part. Each producer is using his own internal configuration.

The production base is more than adequate. The use of performance specifications is a tool used by procurement to get the best product at the lowest cost.

(3) US supply system impacts. A stable supply status is developed in this case.

(4) IL implication. IL demands make up about 10 percent of the total demands. Configuration problems would exist with or without IL demands.

e. Sole source.

(1) Situation. Production of the M60 final-drive sprocket is limited to one company.

(2) Corrective action. TARCOM has identified the sprocket as a pacing item and is giving it high management intensity.

(3) Impact on US supply system. The government relies on the sole-source producer even though the item is open for competitive bid because no other manufacturer can match the low price of the sole source. The producer can more than adequately meet all demands, existing or projected. Thus, the government has no reason to seek additional producers.

(4) IL implication. Careful CRDD determination will prevent any IL-generated supply turbulence.

f. Buy American.

(1) Situation. A small business contract for this VRC-12 module was awarded in May 1972. Deliveries were scheduled to be completed

by February 1973. The contractor failed to comply. A new schedule was drawn up in December 1974 for deliveries in 1975. In January 1975, the Defense Contract Administration Service (DCAS) alerted ECOM to a possible contractor violation of the Buy American Act because the cost of US inputs to the item did not exceed 50 percent of the cost of all components. As a result, this item already in a short position, became more critical because work ceased while an investigation was conducted. Other producers were available.

(2) Corrective action. The contractor was investigated. It was determined the contractor was buying subassemblies from a foreign manufacturer. However, the components of these subassemblies were produced in the US.

(3) Impact on US supply system. The US production base is more than adequate. The producer had gone overseas to reduce his costs. The short supply position did not result from inadequate forecasting or heavy IL demands. The DCAS decision to investigate was the proper one, but it did aggravate a poor supply situation. This case illustrates the indirect effects which foreign suppliers can have on the availability of parts.

(4) IL implication. IL activity for this item was not significant. This case is significant because it documents the foreign customer's preference for the US supply system even when he possesses the necessary industrial capacity.

g. Capacity.

(1) Situation. An M60 element is critical to the air cleaner filter system. The present contractor is producing near capacity. At present production levels, this item may be in short supply if demands increase.

(2) Corrective action. A second source has expressed interest and is in the process of qualifying their filter assembly. Upon successful completion of the tests, maximum capacity will be increased significantly.

(3) Impact on US supply system. The potential capacity of the industrial base far exceeds demands. Before a producer will tool up to pass a product through first-article testing, the procurement authority must be able to forecast a demand pattern (US and IL) sufficient to justify the high initial costs associated with additional industrial capacity.

(4) IL implication. IL demands make up a small part of total recurring or nonrecurring demands. The decision to expand is largely independent of IL activity.

h. Engineering.

(1) Situation. The material for a cylinder used in the M60 was changed from aluminum to steel. In an effort to eliminate the older cylinder faster, a technician without coordinating concurrence reduced wear limits. The result was increased demands for the new cylinder.

The production capacity for either aluminum or steel cylinders is more than adequate to meet the increased level of demands.

(2) Corrective action. Wear limits were increased again. Thus the old cylinders were given a greater lifespan.

(3) US supply system impacts. The increased demands invalidated budget forecasts; then reduced demands freed funds for use elsewhere.

(4) IL implication. IL activity was not significant and did not contribute to the increased demands pattern.

10. User Issues.

a. Depot requirements.

(1) Situation. An AN/VRC-12 electrical control module is in short supply position due to unprogramed depot overhaul requirements. The depot underestimated the number of modules required in their rebuild program. The production base has the capacity to meet any forecasted demand.

(2) Corrective action. The short asset position was corrected by an expedited flow of reparable items and the award of a supplemental agreement to an existing contract.

(3) Impact on US supply system. Repair part customers were deprived of parts so the depot program would not be stopped. These unprogramed demands invalidated the MSC requirements and budget forecast.

(4) IL implication. Israel, Iran, and a number of other IL customers generated a number of nonrecurring demands. The commitment

dates for these IL demands, in general, were met before the shortage occurred. The following unexpected shortage could create the impression that IL diverted US assets. A direct delivery policy would prevent this.

b. Funding limitations.

(1) Situation. In July 1976, ODCSLOG initiated a study of the 23 weapons systems below Operational Readiness standards in USAREUR. The objective of the study was to evaluate the effectiveness of wholesale support to the user. (102)

(2) Corrective action. Action is being taken to improve the flow of supply information between DA and USAREUR in an effort to improve the operational readiness rate of the 23 weapons systems.

(3) Impact on US supply system. The study concluded that funding limitations, not the US supply system, are the principal constraints which effect performance at every level, from the using unit up to the CONUS wholesale supplier. When user units lack sufficient operating funds, they order the next higher assembly which receives "free issue" as a PAA secondary item. This practice can disrupt requirements and budget forecasts at wholesale level.

(4) IL implication. These 23 weapons systems represent a large part of the Army systems sold through FMS. The list includes the M60, M113, HAWK, and TOW. The above constraints may lead US units to perceive that IL customers are the cause of supply shortages.

c. Return of excess.

(1) Situation. Excess M60 repair parts were being disposed of at installation level. They did not qualify for return to the tank parts inventory because parts had their full requirements objective on hand or on order. This rule applied even if there was zero stock on hand with full procurement on order. Thus, many expensive unnecessary procurements were made.

(2) Corrective action. In January 1975, TARCOM placed an override on the excess return system causing return of all serviceable excess parts to inventory.

(3) Impact on US supply system. Since January 1975, over $24 million in excess parts were returned to the inventory. This has the positive direct result of reducing new procurement quantities.

(4) IL implication. Recovery of excess assets would have reduced any IL-related supply turbulence in the M60 area.

IV. ASSESSMENT OF WEAPONS SYSTEM SUPPORTABILITY

11. <u>Symptoms and Causes</u>. The preceding section illustrated a wide range of production, procurement, and user issues impacting the quality of repair part support provided by the US supply system. Each case contained a description of management action taken. In most cases, action was <u>reactive</u> and <u>limited</u> to symptoms of the problem at hand. A method of directing corrective actions at the causes of problems is required.

12. Management Tools. An effort was made to identify a management tool which could be used to surface problem causes. The initial search was directed at identifying IL-related causes. Preceding paragraphs illustrate, however, that IL customers themselves seldom if ever generate problems for the supply system during routine sales. Therefore, the method used to uncover problem causes should not be IL oriented but rather oriented towards the total US supply system. An assessment of weapons system supportability is a practical and logical approach to this task. US procedural standardization permits easy transition from examination of specific weapons system problems to conceptual problems with the total supply system. Although no document currently answers this requirement, there are several documents which approximate it. These documents are generated on a nonrecurring and a recurring basis.

13. Nonrecurring Report.

a. Background. In October 1974, MICOM completed a comprehensive study and evaluation of repair part problems that delayed deployment of Improved HAWK in Europe in 1974. The two-phased study was in part precipitated by the 1972 sale of HAWK to Iran. Phase one was devoted to Improved HAWK repair parts problems. The second phase was expanded to include the total MICOM repair parts acquisition process. Phase one revealed 18 factors contributing to repair parts problems. These factors provided a broad view of causes of repair parts shortages. Of the 18, 3 related directly to IL customers (i.e., Iran, commercial direct sales (CDS), and NATO support). A greater number were nearly independent of IL and relate to the discussion in paragraphs 7 through 10 of this annex. The list includes overly optimistic reliability factors, test and training support, changes in US deployment schedules, converting from contract to depot production, material management and procurement process interfaces, contractor priorities, and engineering changes. Several factors may have been aggravated by IL, but most factors contributing to HAWK repair parts shortages related to US supply system management. (120)

b. Strengths. The HAWK repair parts study was a thorough effort designed to address causes of a then current problem. It provided a total perspective on the support of the Improved HAWK system. This perspective indicated support problems were not unique to the Improved HAWK, but common to other missile systems. Conclusions and recommendations were thus extended to improving the entire supply system. It is interesting to note that some of the CSP computation and IL program integration problems rediscovered in this study were originally surfaced in the October 1974 report.

c. Limitations. The Improved HAWK study was a one-time effort in response to a particular problem. It was not iterative nor did it incorporate any ability to identify specific future problems, supply shortages, or impacts.

d. Evaluation. The HAWK study was a complete and well-documented effort. It was a leader in the effort to provide Army management with a total systems view of end item support. Completed at significant cost of time and manpower, the study led to the development of a brilliant recurring management-oriented report, the MICOM repair parts Visibility system.

14. Recurring Reports. Three recurring reports are evaluated. They are the MICOM Visibility report, DARCOM System Assessment/Red Team report, and the DARCOM Review and Command Assessment of Projects (RECAP). Also discussed is a fourth management tool, the procurement management system (PROMS) which is still in the conceptual stage.

a. MICOM Visibility report.

(1) Background. Visibility was designed as a result of the October 1974 MICOM repair parts study. As the study progressed from examining HAWK-peculiar problems to supply system problems, it became evident a method of obtaining visibility of a parts supply status was required. MICOM thus developed Visibility, a fully automated method of extracting, summarizing, and displaying in a concise format, data from primary CCSS subsystems. Visibility identifies by national stock number (NSN) all medium or higher management intensity parts that will be in a minus support posture (i.e., no issuable assets on hand) sometime during the remainder of the apportionment and budget year. Thus, the forecast range is 15-24 months. Adequate backup data are provided to identify the probable cause of the shortfall.

(2) Strengths. Visibility is fully integrated into CCSS. It requires no external inputs. The management review of Visibility output causes an audit of CCSS data. This is not routinely done at any other time. The program has a "what if" option usable for assessing IL or other impacts on the overall supply system.

(3) Limitations. Command interest must be behind Visibility as its sole function is to highlight problems in other people's operation. A positive Command attitude, as exists at MICOM, makes Visibility a powerful tool.

(4) Evaluation. Visibility is brilliant in its simplicity. It is a great breakthrough in automated management tools. Visibility should be used at all MSCs.

b. System Assessment/Red Team report.

(1) Background. This program is used by DARCOM to identify user problems and take corrective action. System assessments are performed by the weapon system proponent and take the form of initial or update system assessments. Independent assessments, performed under the direction of HQ DARCOM, are termed Red Team reports. Red Team reports are limited to combat critical Army systems. Fourteen systems will receive a Red Team analysis during FY 77. As a minimum, system/Red Team assessments will cover the following topics: development history (not required for update assessments), field performance, rebuilt/storage reliability, user opinion, current problems, development initiatives for

replacement, system improvement plan, and a commander's overall assessment. The current problem section discusses system performance, operational readiness, manuals, training, personnel, maintenance, supply management, safety, technical support, stockpile reliability, and special facilities, depot experience, equipment improvement reports, modification work orders, and foreign sales and international marketability. The commands/project managers have the prerogative to use any format which adequately covers these topics. The form most frequently used is a collection of case studies on the most serious current problems facing the system. (92)(105)(107)(125)(127)

(2) Strengths. In the course of the study, the following system assessments were reviewed: VRC-12 (June 1975), M60 Series (December 1975), M113 (January 1976), TOW (October 1976), and Improved HAWK (October 1976). These documents are thorough and comply with the basic regulation (DARCOM Reg 702-9) (107) and circular (DARCOM Cir 702-2) (105). They are historical and deal with current problems and their solutions. These documents are written with the user in mind since solving the user's problems is a major part of a project/product manager's job. The Red Team analysis is particularly effective in that it provides an independent view which tends to improve the proponent's system assessment.

(3) Limitations. The system assessment contains a wealth of "firefighting" information, but falls short in four areas required for total systems management. First, the "close hold" aspect of these reports

has led to limited distribution and comparison across the board. Many middle-level managers in the field are not aware of system assessments. The second area is a total view of "where we are." The present report is based on a collection of several problems but does not provide any standard data for the reader to draw perceptions across systems. The third area is a better view of "where we will be." The future-looking aspects again are case oriented and do not include a systematized approach to problems other than those identified. This would permit a more complete assessment of impacts generated by sales of end items and repair parts to IL customers or any other problem under review. The final area is a better view of "total supply system problems." DARCOM does not routinely conduct an overview analysis of the system assessments to uncover system-wide problems. As a result, the potential benefit from over 70 system assessments has not been fully exploited.

(4) Evaluation. The excellent historical information contained in the System Assessment/Red Team report should be exploited to minimize the US supply system impacts from IL or any other source. This report presents a perfect vehicle for DARCOM to both indirectly and deliberately surface problems. Indirect problem discovery would occur during the DARCOM overview analysis. Deliberate problem discovery could occur by DARCOM directing inspection of specific possible problem areas. Command emphasis is needed to translate system assessment emphasis from the past to the future.

c. RECAP.

(1) Background. RECAP is the management tool used by the DARCOM command and staff to obtain concise and timely information on which to monitor project/product progress while a weapon system is still in the developmental or deployment stage. This information is generated by project/product managers. It is presented at least annually. RECAP serves as the basis for the DA Program Report (DAPR). Briefings are presented by the project/product manager. They address significant events and existing or potential problem areas which require the attention of DARCOM or higher headquarters. The RECAP format is specified in detail. Included as topics are performance status, program acquisition, cost, RDTE and procurement costs, integrated logistics support, delivery schedules, foreign sales status, and project highlights. (106)(116)(121)

(2) Strengths. RECAP provides a systematized procedure to ensure that high-priority systems receive a thorough, rigorous review at the highest levels. The standardized format permits comparison across systems.

(3) Limitations. RECAP documents contain sensitive cost and schedule material and are marked with special handling instructions. This treatment may preclude managers below DARCOM level from taking a view across several systems. Within the report itself, there is little information which places the project/product into an Army or DARCOM perspective, either in terms of dollars or number of lines. While

providing a good summary of production and scheduling information, its view of integrated logistics support may be too highly aggregated.

(4) Evaluation. RECAP is an excellent management tool for high-level information. It has limited use as the basis for action by managers at either the project, MSC, DARCOM, or DA level.

d. PROMS. PROMS was developed by DARCOM to improve the management of procurement operations and organizations. (139) It is a planning structure which translates DARCOM's command goals into objectives, tasks, and finally subtasks which are performed at the MSC level. PROMS' strength is that the MSC participates in setting its goals. DARCOM looks to the MSC only for results. This process includes feedback on the nature and the adequacy of actions taken at lower levels. This system's first cycle began in July 1976 when the P&P Directorate at DARCOM forwarded to the MSC a set of broad objectives for FY 78. After several iterations, a refined list of objectives and specific supporting tasks was approved. This list is an input to the DARCOM plan. PROMS does have its limits. It looks only at present performance and does not deal with functions other than procurement. Also, IL considerations are specifically excluded from the budget-related objectives of price competition, formal advertising, and small business volume. Nevertheless, PROMS is in the midst of its first cycle and offers significant potential if combined with other management tools like MICOM's Visibility system. (139)

V. CONCLUSIONS AND RECOMMENDATIONS

15. Conclusions.

a. US industrial capability is adequate to satisfy US and IL peacetime repair part requirements in the FY 77-81 time frame. This conclusion is based on the results of specific part supportability tests and a more general industry trend test.

(1) Specific tests. The test of specific repair parts was based on a sample extracted from five critical systems of varying densities and importance. A worst-case estimate of future total US supply system repair part requirements indicated the production capability of known US bidders exceeded US and IL requirements in all cases. In many cases, an excess capability of 200 percent or more exists. However, part shortages do exist. These shortages occur when the delicate balance between assets, funds, and time is upset in the material management process. Often industrial base production capability and IL customers are incorrectly identified as the source of the shortages. These misconceptions are due to misinterpreting the management considerations driving the US supply system and misinterpreting the failure of one contract as an entire industrial sector failure.

(2) General test. A trend analysis of 19 industrial sectors established that no production capability constrictions are expected in the FY 77-85 time frame. The analysis was conducted using US Department of Commerce data to verify the optimistic predictions of US industrial capability developed using MSC data.

b. Methods for assessing weapon system supportability exist but are not exploited, The MICOM Visibility forecast provides a powerful tool for assessing short-term (i.e., 0-2 years) weapon system supportability. The "what if" option available in Visibility makes it suitable for assessing the impact of an IL sale or other US Army action on overall weapon system supportability. Mid-term supportability assessments (i.e., 2-5 years) could be made using the DARCOM system assessment program. However, the current trend in system assessment reports is historically oriented rather than future oriented.

16. Recommendations.

a. The MICOM Visibility forecast should be immediately adopted throughout DARCOM. This powerful management tool should be exploited to purify data in CCSS files and permit execution of positive material management actions before short supply situations occur. In addition, the Visibility forecast "what if" option should be exercised to assess impact of significant IL sales or other US Army actions on overall supply system performance before the sale or action is taken.

b. The DARCOM system assessments program should be oriented towards preventing future problems rather than reporting historical problem solutions. Incorporation of the MICOM Visibility forecast into the program and substantially increasing input from MSC IL directorates would also strengthen the report. Each report should also be used to identify supply system problems affecting all weapon systems rather than problems peculiar to only the specific evaluated weapon system. An assessment program with this positive orientation would identify turbulent supply situations described in Section III of this annex before serious problems could develop.

LAST PAGE OF ANNEX B

APPENDIX B-1

EVALUATION OF SUPPORTABILITY OF SELECTED PARTS

1. Purpose. This appendix assesses the capability of the US production base to meet requirements for specific repair parts through FY 81 and illustrates the usefulness of an existing MICOM management tool to assess the impacts of IL sales.

2. Scope. This appendix:

a. Evaluates the accuracy of end item inventory information.

b. Displays the best estimate of current and maximum projected inventories for the five sample weapon systems under study.

c. Uses inventory data and historical demands to project future demands for selected parts.

d. Estimates levels of current and future production capacity.

e. Draws conclusions regarding the capacity of the US production base to support US and IL inventories in the FY 77-81 time frame.

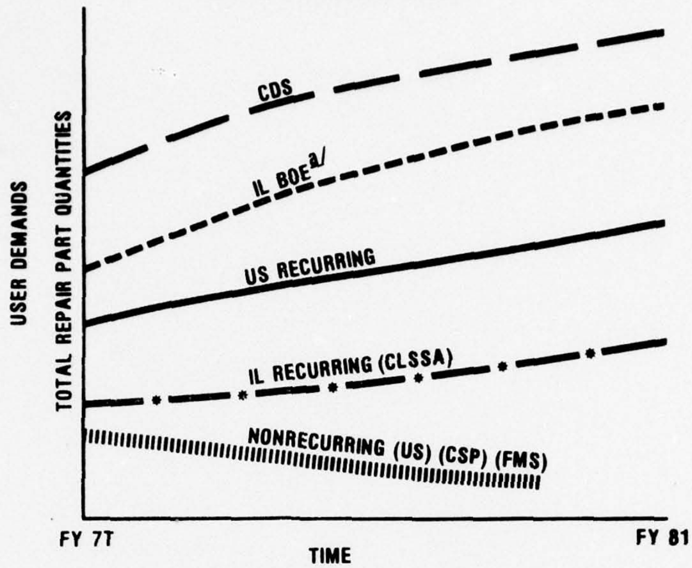
f. Describes an automated management system which has the capability to assess the impacts of IL repair parts sales.

3. Future Requirements.

a. Constraints. Requirements for all programs are ideally determined by establishing the end item inventory requiring support under a program and the demand rate for that program (see Figure B-1-1). ESG originally intended to develop a total requirement in this manner. Adequate information could not, however, be obtained to accomplish this task. As a result, a simplified method of determining a worse case total requirement was developed. An explanation of final determination process follows.

b. Inventories. Establishing the inventories requiring support was the first task undertaken. Data on past equipment deliveries were obtained from MSCs and the Defense Security Assistance Agency (DSAA). Questionnaires were sent to DIA and select Military Assistance Advisor Groups (MAAGs) to determine actual inventories on hand in foreign countries. It was hoped this information would provide insights into equipment loss rates (i.e., accidental destruction and maintenance washouts). It did not. The questionnaire also requested inventories be stratified by equipment usage category (i.e., storage, Active forces, Reserves) and that an estimate of inventory increases be submitted. This was also unsuccessful. Other estimates of future inventory increases were obtained from the ODCSRDA Security Assistance Master Planning and Phasing Worksheets (SAMPAP) and the DOD Military Security Assistance Projection (MSAP). The SAMPAP records all potential sales from the time the IL customer requests price and budgeting data (P&B). (86) Theoretically, the MSAP identifies potential sales that have not yet reached the P&B stage. Summary comments on the data these sources provided are shown in Figure B-1-2. Select inventory relationships are displayed in Figure B-1-3. A search for data was also made in the Army POM and in CDS records in the FORDAD report (see Appendix A-3). No new information was found in the Army Program Objective Memorandum (APOM). (37) Except for radios, past CDS end item activity was low or not identifiable and not included in current inventory data. The MSC and SAMPAP inventories appeared to be the most reliable and thus were selected as baselines (see Figure B-1-4).

PROGRAM DEMAND RATES



REQUIREMENT = INVENTORY SUPPORTED × DEMAND RATE

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a/ Although BOE demands are nonrecurring, IL customers use the program as a replenishment program. Thus, it was planned to show it separately as a recurring replenishment program.

Figure B-1-1

c. Program demands. Establishing individual program demands was the next task. IL demand information was obtained directly from the RDES Demand Return and Disposal File (DRD) historical summary. CSP, FMS-defined line, and BOE demands are rolled up in the DRD. Various efforts to gain more visibility of the individual demand pattern of these programs were not successful (see Annex A and Appendix A-2). US nonrecurring and the combined US and IL recurring demands were taken from the RDES item management plan forecasts. Thus, these demands were already inflated to indicate what current inventories should need.

SOURCES OF INVENTORY DATA

	Current Inventory		Current and Future Inventory		Future Inventory	
Review of Data	MSC	DSAA	DIA	MAAG	ODCSRDA	ASD(ISA)
Type of record	.Normal MSC record	.Special RCS 1100 printout for ESG	.Special report for ESG	.Special report for ESG	.SAMPAP-recurring quarterly report	.MSAP-recurring annual report
Source of data	.Internal MSC record	.MSC via RCS 1000 system	.Various sources	.Various sources	.USAILCOM and MSC	.MAAGs
Normal data use	.Historical record of end item deliveries	.Historical record of end item deliveries for various Congressional uses	.Intelligence analysis	.Not normally maintained	.FMS management and procurement planning	.FMS planning
Intended ESG use	.Establish current equipment inventories potentially requiring support	.Verify MSC data	.Stratify in-country usage category (i.e., active force, storage, etc.) and determine expected future purchases	.Verify or improve quality of DIA data and collect data on country plans for support	.Establish future sales up to point country has requested P&B data	.Establish "maximum" expected future sales
Security classification	UNCLASSIFIED	CONFIDENTIAL	.Up to SECRET--varies with country	.Up to SECRET--varies with country	CONFIDENTIAL	TOP SECRET
General ESG comment	.Potential exists to prepare more accurate total country support plans through the use of this data	.Potential exists for Congress to receive inaccurate data due to non-standard manner in which items are listed	.Data proved of little value for logistical support planning	.Data proved of little value for logistical support planning	.An excellent document	.Data were of little value for logistic planning
Detailed ESG comment	.MSCs lack standardized recording practices resulting in decreased information visibility .Country desk officers do not use data to design total country support program .After end item delivery, MSC seldom uses this data	.Data groupings are unclear in areas of missile weaponry, radios, and systems composed of several end items .Older data grouped by generic weapon description and not by specific models	.DIA does not regularly receive input on actual FMS or CDS activity from DA or other DOD elements .Data on usage category of equipment in country were not generally available .Data on expected country purchases were not available	.Data on usage category of equipment in-country were not generally available .Data on country follow-on support plans were nebulous	.MSC IL and Material Management Directorates were not using this data for repair part support planning	.No cutoff date was used to form a data baseline. As a result, it was not possible to add this data to the SAMPAP to illustrate a "maximum expected" FMS requirement
Recommendations	.Country desk officer should maintain constant visibility of country's past, present, and future FMS status to advise on repair part support needs	.USAILCOM should review and clarify DSAA data to ensure DA involvement in FMS is accurately depicted	.DA should provide DIA and other intelligence agencies with data on past and future FMS and CDS activity	.Except for special cases, do not use this source again	.Use data for impact assessments using MICOM "visibility" forecast--see Annex C for details	.Recommend DOD clarify data baselines .Use at DA Staff level when reviewing MSC support planning impact assessments

Figure B-1-2

IL INVENTORY RELATIONSHIPS[a/]
(End FY 7T)

	DSAA	DIA	MSC
AN/VRC-12 Radio Family	.86	.11[a/]	1.00[b/]
M113 APC Family	1.01	.96	1.00
M60 Tank Family	1.00	1.23[c/]	1.00
TOW	.08[d/]	1.03[c/]	1.00
Improved HAWK (Launchers Only)	Not Determinable[d/]		1.00

a/ Radio visibility is lost when included in other weapon systems.

b/ MSC inventory is the base. For example: radio inventory data provided by DIA were only .11 as large as inventories reported by MSC.

c/ DIA counts generic items (e.g., medium tanks) and not specific models.

d/ DSAA counts missiles and not launchers. Therefore, TOW and HAWK inventories were obscured.

Figure B-1-3

d. Future requirements. Determining future requirements was the final task. This determination was based on inflating the demand rates, which were skewed to be indicative of worst-case situations, by a program change factor (PCF). The PCF used the end FY 7T inventory as a denominator and the end FY 81 inventory as the numerator. A separate calculation was made for IL nonrecurring, US nonrecurring, and the combined US and IL recurring demands. In the recurring demand category, it was assumed that at least the number of IL customers that use CLSSAs now will use

PRESENT AND FUTURE US AND IL INVENTORY RELATIONSHIPS[a]

		FY 7T	FY 81
AN/VRC-12 Radio Family	US	1.00	1.24
	IL[b]	.82	.69
	IL Under CLSSA	.18	.15
M113 APC Family	US	1.00	1.31
	IL[c]	1.97	2.64
	IL Under CLSSA	1.11	1.50
M60 Tank Family	US	1.00	1.51
	IL[d]	.30	.26
	IL Under CLSSA	.23	.20
TOW	US	1.00	1.83
	IL[e]	.67[a]	.83
	IL Under CLSSA	.36	.47
Improved HAWK Launcher	US	1.00	1.37
	IL[d]	.29	.86
	IL Under CLSSA	.27	.79
Improved HAWK High-powered Illuminator	US	1.00	1.32
	IL[d]	.31	.82
	IL Under CLSSA	.27	.68

a/ Relationships shown as ratios of IL to US inventories. US FY 7T inventory is the base. For example: the FY 7T IL TOW inventory is only .67 as large as the US FY 7T inventory. The FY 81 US TOW inventory will be 1.83 as large as the US FY 7T inventory. The IL FY 81 TOW inventory will be .83 as large as the US FY 81 inventory.

b/ Includes past CDS deliveries.

c/ Past CDS deliveries were too insignificant to count.

d/ No CDS activity recorded.

e/ Includes future CDS deliveries.

Figure B-1-4

them in the future. Thus, future CLSSA inventories were estimated to be equal to the same percentage of the total future IL inventory as it is now (see Figure B-1-4). The entire exercise became academic, however, when the tremendous excess of industrial base capacity was noted in all cases. Even if additional demand increments for CDS were added (see Appendix A-3), the US industrial base would not be taxed.

e. Inventory intelligence. A final comment must be made concerning the value of accurately knowing an IL customer's on-hand inventory. For logisitical support purposes, this knowledge is of little value. The self-leveling effects of the AMD and PCF in RDES will in a short time dampen any unexpected demands resulting from customers not truly identifying the supported inventory. Additionally, good IL program policies and procedures will make the customer wait a full leadtime for any items not bought under a CLSSA. Although it would be better to accurately know a customer's inventory, it is not critical. For operational planning and for management of the DA security assistance program, this knowledge is important and should be known. The US intelligence community should establish this. Also, action should be taken to provide FMS and CDS sales data available in the logistics community to DIA. As noted in Figure B-1-2, DIA does not routinely receive any of these data. As a result, the quality of data DIA provides to ITAD, ACSI, and others may be degraded.

4. <u>Future Production Requirements and Capabilities</u>. Figure B-1-5 summarizes the comparison between future requirements and production capability. The first part of this figure displays an estimate of the average yearly recurring and nonrecurring demand in FY 81 for each NSN on the selected parts list presented in Annex B. The second part of Figure B-1-5 estimates the current and projected parts output of the production base. These estimates were provided by MSCs. The current production capacity is based on the capacity of only those producers presently under contract. The future capacity is based on the total capacity of all producers who have or can be expected to bid on the item.

5. <u>Comparative Examination</u>. A comparison of requirements and capabilities in Figure B-1-5 shows an overage of capacity both in the current time frame and in FY 81. The paragraphs below will discuss the repair parts status by system.

a. VRC-12. The current production of radio repair parts far exceeds projected demands. Should a problem develop, producers have a large unused capacity which can meet these demands. ECOM's strength is due to the modular nature of the VRC-12 and to the similarity between military and civilian components.

b. M113. The production capacity for the M113 items again exceeds demand requirements. However, that capacity takes time to activate. Analysis of this excess capacity must take into consideration past problems which are discussed in Annex B.

SPARE PARTS REQUIREMENTS AND PRODUCTION CAPABILITY

System	NSN	Nomenclature	Procurement Leadtime Rqr (Months)		Future Maximum Estimated Yearly Demand				Maximum Yearly Production Capability	
			ALT	PLT	Recur	Nonrecur US	Nonrecur IL	Total	Current	Future
VRC-12	5820-00-087-0061	A1000 Module	4.5	11.0	182	166	52	400	8,400	16,800
	5820-00-089-0911	Guard Assy	3.0	9.0	838	285	--	1,123	6,000	18,000
	5820-00-437-2353	Ant Tip Assy	4.5	4.0	64,800	5,881	--	70,681	72,000	120,000
	5820-00-853-5915	A2000 Module	1.0	10.0	3,160	892	5	4,057	7,800	19,200
	5820-00-853-5917	A1200 Module	4.5	7.0	2,695	594	10	3,299	3,600	12,000
	5820-00-856-2730	AT1096 Ant Sub Assy	5.5	10.0	4,071	160	10	4,241	6,000	18,000
	5820-00-878-4608	A6000 Module	2.5	8.0	215	84	11	310	3,600	8,400
	5820-00-884-2475	A8400 Module	4.5	9.0	331	1,042	432	1,805	1,200	3,600
	5820-00-884-2479	A8100 Module	2.5	10.0	211	775	411	1,397	3,000	6,000
	5820-00-892-3339	C2298 Control	5.0	11.0	515	6,516	2	7,033	20,400	756,000
	5820-00-892-3342	AM 1780 Amp	6.0	15.0	195	4,158	13	4,366	4,800	10,800
	5820-00-995-8687	Power Supply Module	1.5	8.0	1,265	253	793	16,115	4,800	16,200
	5915-00-431-6718	Trans Suppressor	5.0	11.0	200	14,894	33	15,127	2,400	21,600
	5960-00-892-3808	Elect Tube	4.5	9.0	4,859	645	666	6,170	12,000	36,000
	5985-00-985-9024	AS1729 Antenna	5.0	15.0	226	26,083	61	26,370	18,000	84,000
	5995-00-823-2827	Cable Assy	3.2	11.0	389	135	11	535	1,200	8,400
M-113	2520-00-572-8605	Trans Gear Case	3.0	22.0	252	33	--	285	3,600	3,600
	2520-00-698-8382	Sprocket, Final Drive	6.0	12.0	2,044	66	--	2,110	2,400	7,200
	2920-00-981-4936	Starter, Generator	4.7	8.8	547	214	--	761	2,400	2,400
	2930-00-168-4896	Radiator	12.0	16.5	1,576	140	--	1,716	7,200	14,400
	3020-00-141-1154	Sprocket	5.6	11.3	11,348	2,548	--	13,896	18,000	36,000
	3020-00-572-8717	Gear	6.0	31.0	257	553	--	810	12,000	36,000
	3020-00-866-9373	Gear	4.0	18.0	145	329	--	474	12,000	36,000

(Figure B-1-5 Continued on Next Page)

SPARE PARTS REQUIREMENTS AND PRODUCTION CAPABILITY--Continued

System	NSN	Nomenclature	Procurement Leadtime Rqr (Months)		Future Maximum Estimated Yearly Demand				Maximum Yearly Production Capability	
						Nonrecur				
			ALT	PLT	Recur	US	IL	Total	Current	Future
M60	2520-00-692-5026	Gear Set	6.0	12.0	999	124	--	1,123	4,320	4,320
	2520-00-753-9886	Carrier	4.0	14.0	56	63	--	119	120	160
	2530-00-701-3976	Wheel	6.0	12.0	7,122	1,329	631	9,082	60,000	84,000
	2530-00-784-9292	Wheel	3.0	8.0	9,022	879	21	9,922	48,000	96,000
	2851-00-856-9005	Engine	4.0	13.0	892	6	--	898	3,000	4,200
	2920-00-088-3989	Regulator	4.0	8.0	1,681	133	5	1,819	4,200	—
	2920-00-830-6660	Generator	3.0	9.0	1,625	80	--	1,705	7,200	10,800
	2940-00-070-1112	Filter	4.0	8.0	2,042	8	2	2,052	14,400	28,400
	2950-00-397-3385	Turbo	5.0	11.0	401	41	--	442	4,800	4,800
	3020-00-252-5637	Sprocket	3.0	12.0	7,068	639	123	7,830	6,000	18,000
	4140-00-162-2615	Blower	3.0	14.0	2,353	59	11	2,423	6,600	6,600
HAWK	1430-00-155-8288	Sim Center	3.0	19.0	21	70	167	258	120	2,400
	1430-00-433-9137	Printer Wiring	3.0	6.0	29	25	142	196	24,000	Unlmt[a/]
	1430-00-451-1054	Electric Comp	3.0	18.0	243	103	166	512	3,600	Unlmt
	1430-00-491-6943	Amp Int Freq	3.2	16.0	193	33	142	368	120	240[b/]
	1430-00-491-6945	Circuit Card Assy	3.2	23.0	19	37	202	258	480	Unlmt
	1430-00-484-7998	Control Radar Set	3.0	29.0	34	44	80	158	120	2,400
	1430-00-493-9118	Electric Comp	3.0	12.0	16	37	195	248	120	Unlmt
	1430-00-626-8315	Amp-Conventional	4.0	32.0	80	10	5	95	240	Unlmt
	1440-00-316-0179	Stud Retaining	1.2	6.0	179	7	211	397	19,200	Unlmt
	1440-00-394-9792	Tube, Telescope	3.2	11.0	15	19	4	38	480	Unlmt
	1440-00-480-7589	Amp, Audio	3.0	23.0	293	119	89	501	12,000	Unlmt
	1440-00-481-2798	Cable Assy	4.2	11.0	31	12	24	61	4,800	24,000
	1440-00-481-2800	Cable Assy	3.0	13.0	21	16	122	159	7,200	Unlmt
	5830-00-566-1475	Intercommunicate	4.0	6.0	152	73	157	382	4,800	100,000
	5915-00-433-9149	Filter, High Pass	6.2	19.0	77	21	65	163	6,000	Unlmt

(Figure B-1-5 Continued on Next Page)

SPARE PARTS REQUIREMENTS AND PRODUCTION CAPABILITY--Continued

			Procurement Leadtime Rqr (Months)		Future Maximum Estimated Yearly Demand				Maximum Yearly Production Capability	
						Nonrecur				
System	NSN	Nomenclature	ALT	PLT	Recur	US	IL	Total	Current	Future
TOW	1430-00-147-2092	Missile Guidance	3.0	16.0	23	49	5	77	240	Unlmt
	1430-00-464-1070	Circuit Card	3.0	21.0	28	51	24	103	1,200	Unlmt
	1440-00-140-1529	Sight, Optical	3.0	18.0	68	181	5	254	4,800	22,600
	1440-00-140-9836	Elec Pre Amp	3.0	17.0	23	112	55	190	Unlmt	22,600
	1440-00-455-5905	Traversing Unit	3.0	19.0	9	44	19	72	4,800	36,000
	1440-00-455-9406	Tracker Assy	3.0	17.0	17	84	--	101	4,800	36,000
	1440-00-455-9415	Sensor Assy	3.0	16.0	19	82	--	101	4,800	19,200
	1440-00-462-2553	Damper, Azimuth	3.0	16.0	17	5	7	29	9,000	45,000
	1440-00-462-2728	Cable Assy	3.0	9.0	75	18	--	93	Unlmt	Unlmt
	1440-00-522-0182	DC Regulator Assy	1.0	16.0	33	20	--	53	Unlmt	Unlmt
	1440-00-723-7329	Electronic Modulator	3.0	9.0	24	88	--	112	Unlmt	Unlmt
	6130-00-538-0407	Power Supply	6.0	18.0	33	92	97	222	2,400	Unlmt
	6140-00-454-8261	Batt Assy Storage	3.0	14.0	50	161	--	211	19,200	38,400
	6650-00-400-7621	Prism, Boresight	3.0	17.0	15	95	5	115	2,400	2,400

a/ "Unlimited" production capability is the term used by MICOM to describe the case where the number of producers for an item exceeds 100.

b/ Demand rates for this part are extremely high considering its $7,000-11,000 unit cost. MICOM initiated action to evaluate part engineering reliability and to reassess production capability. A 406 growing to 783 annual overhaul demand is also expected. Present depot overhaul capacity is 540 units annually. MICOM expects no problems increasing new production and overhaul capabilities to meet these future demands because of the leadtime available before they occur.

Figure B-1-5

c. M60. Current and future production capacities far exceed the demands likely to be generated by FY 81. The M60 program has benefited from the Presidential DX priority and intensive management following the 1973 Middle East War.

d. Improved HAWK. In each case, MICOM's estimate of the future capacity of the production base exceeds the projected demands if the production capability is activated in a timely manner. Analysis of the HAWK repair parts reveals nonrecurring demands, and particularly IL demands, are the major supply driving forces in the supply system. These forces are placing five repair parts into a short supply situation. The demand pattern for these five items is marked by the three same characteristics: low IL recurring demands, higher US nonrecurring demands, and IL nonrecurring demands which exceed the sum of the first two. The Jordan Improved HAWK sale accounts for the high nonrecurring demand. Had the Jordan sale not required delivery in less than a normal leadtime, no impact on US forces would have occurred.

e. TOW. Current and future production levels far exceed the total demands. Now that politically motivated decisions to provide early delivery of TOWs have stopped, few future problems should develop.

6. Visibility. Considering the potential production capability available, it is difficult to understand why part shortages exist. It would appear that some management tool could be developed to help the

US better manage the supply system to exploit the available production capability. A management tool known as Visibility can do this. Visibility is a MICOM-developed automatic system for forecasting the supply status of a weapon system 15-24 months into the future (see Annex B). It is a great breakthrough in automated management aids. At almost no manpower resource cost, item managers are presented a comprehensive listing of all potential problems the parts they manage may encounter. A Visibility listing may be prepared periodically for general management purposes or as needed for specific evaluation purposes. For example, an impact statement could be prepared on every IL repair part sale based on a Visibility listing. Following paragraphs illustrate two uses of Visibility. First is an analysis of 20 HAWK and TOW repair parts to determine what supply process elements need attention for each item (Figure B-1-6). Second, expected supply status trends for the Improved HAWK and TOW weapon systems are presented to draw conclusions on overall system supportability. Use of Visibility lists surface the same problem causes discussed in Annex B in a fraction of the time and, more importantly, before a critical supply status occurs.

7. Visibility by NSN.

a. Elements. As a passive system, Visibility draws on CCSS subsystems which report on the status of a part through its life cycle. For the purpose of this analysis, this life cycle will be divided into thirds: the requirements determination and execution system process,

VISIBILITY BY NSN

Part No.	NSN	Nomenclature	Visibility Cycle: RDES Time	RDES Qty	Procurement Sched	Procurement Slippage	Repair Sched	Repair Slippage	Attention Areas
HAWK									
1.	1430-00-155-8288	Sim Center	--	--	--	--	--	X	Depot repair slippage.
2.	1430-00-491-6943	Amp Int Freq	--	X	--	--	--	X	Invalid data, repair lagging.
3.	1430-00-491-6945	Circuit Card Assy	--	X	--	--	--	--	Invalid data.
4.	1430-00-484-7998	Control Radar Set	--	--	--	--	X	--	Unscheduled depot repair.
5.	1440-00-316-0179	Stud Retaining	--	--	X	--	--	--	Uncontracted procurement.
6.	1440-00-480-7589	Amp, Audio	--	X	X	--	--	--	Invalid data, uncontracted procurement.
7.	5830-00-566-1475	Intercommunicate	--	X	--	--	--	--	Invalid data.
8.	5915-00-433-9149	Filter, High Pass	X	--	--	--	X	--	Invalid PLT, unscheduled depot repair.
TOW									
9.	1440-00-140-1529	Sight, Optical	--	X	--	X	--	--	Invalid data, unfinalized procurement.
10.	1440-00-140-9836	Elec Pre Amp	X	--	X	--	--	--	Invalid PLT, excessive ALT.
11.	1440-00-455-5905	Traversing Unit	--	--	--	--	--	X	Repair lagging.
12.	1440-00-455-9406	Tracker Assy	--	X	--	--	X	--	Large buy, unscheduled repair.
13.	1440-00-455-9415	Sensor Assy	--	--	--	X	--	X	Repair lagging, unfinalized procurement.
14.	1440-00-462-2553	Damper, Azimuth	--	X	--	X	X	--	Large buy, unfinalized procurement and repair.
15.	1440-00-462-2728	Cable Assy	X	X	X	--	--	--	Excessive ALT, large buy, uncontracted procurement.
16.	1440-00-522-0182	DC Regulator Assy	--	--	X	--	--	--	Uncontracted procurement.
17.	1440-00-723-7329	Electronic Modulator	X	X	--	--	X	--	Excessive ALT, large buy, depot schedule.
18.	6130-00-538-0407	Power Supply	--	--	X	--	--	X	Uncontracted procurement, depot repair slipping.
19.	6140-00-454-8261	Batt Assy Storage	X	--	X	--	--	X	Excessive ALT, repair cycle slipping, uncontracted procurement.
20.	6650-00-400-7621	Prism, Boresight	X	--	--	X	X	--	Excessive ALT, unscheduled depot.

Figure B-1-6

the procurement process, and recycling repair process. Visibility has the ability to focus management attention on specific problems within these three areas by comparing projected data contained in RDES with actual data extracted from supporting CCSS subsystems. Items compared are procurement or repair data in the CCSS NSNMDR, Material Acquisition and Delivery file, Military Standard Contract Administration Procedures (MILSCAP) master file, and Army Maintenance Data Exchange System (AMDEX) depot repair schedule against RDES data.

b. RDES. As a passive system, Visibility performs a valuable service by highlighting questionable data. Thirteen of the 20 parts contain questionable time and quantity data in the RDES file. For example, actual procurement history shows ALT and PLT to be excessive in many cases. In terms of quantity, Visibility shows cases where additional buys should be made and cases where scheduled dues in from procurement exceed the quantity listed in RDES.

c. Procurement. In addition to validating historical information, Visibility performs a greater service of aiding managers assess future impacts of present actions. Seven of the 20 cases show future problems resulting from uncontracted procurement. In four other cases, procurement is unfinalized. In the RDES simulation, these procurements are assumed finalized and deliveries forecasted at the end of the procurement leadtime. This assumption causes incorrect stockage calculations and leads to shortfalls and slippages. Visibility also adjusts the asset level to account for actual deliveries--not just contracted deliveries.

d. Repair. In 12 of the 20 cases, RDES inaccurately assumed assets were arriving from repair. In these cases, Visibility indicates either that this repair capability has not been contracted or that there is a slippage in the deliveries from contractors or depots.

e. Cautions. Visibility is a passive and self-checking system that cannot be influenced by human intervention. It is not a favorite of item managers, procurement analysts, or project managers because it identifies errors in their work. Visibility is not a panacea. It can only direct a manager's attention to potential problem areas. The responsible manager must still take the appropriate action. Visibility is a tool which helps to identify and prioritize those actions.

8. Visibility by System.

a. Overview. The results of the repair part projection by NSN can be aggregated for any group of NSNs. MICOM uses Visibility to examine the intensively managed repair parts in a minus posture. Projections for Improved HAWK and TOW systems are discussed more fully below. It is important to note two aspects of the Visibility output. First, the system stratifies assets for the apportionment year and the budget year. On 30 September, the forecast is made for 24 months; on 30 December, the forecast is for 21 months; on 30 June, the forecast is for 15 months.

Second, a downward slope indicates an improving supply trend and a tight pattern of lines indicates an accurate forecast.

b. Improved HAWK. Figure B-1-7 shows three projections. The 30 June 1976 projection showed a leveling off at the end of a downward trend. This probably indicates a number (150 to 170) of "hard core" repair parts which are not due to "get well." The 30 September 1976 projection shows a significant change in the number of items in a short supply position. This could have been due to the diversion of assets to support the sale of Improved HAWK to Jordan. The 30 September line shows a favorable downward trend and indicates that many of the "hard core" repair part shortfalls have been identified and resolved by management action. The 30 December 1976 projection follows the 30 September line, signifying a good forecast. The later forecast bottoms out at 100 items, 6 more than previously estimated.

c. TOW. The projections for the TOW shown in Figure B-1-8 show much closer agreement both in pattern and trend. The 30 September line is higher across the board but finally dips to only 17 items. The 30 December line validates the previous forecast although there is a slight increase in the number of repair parts in a minus posture.

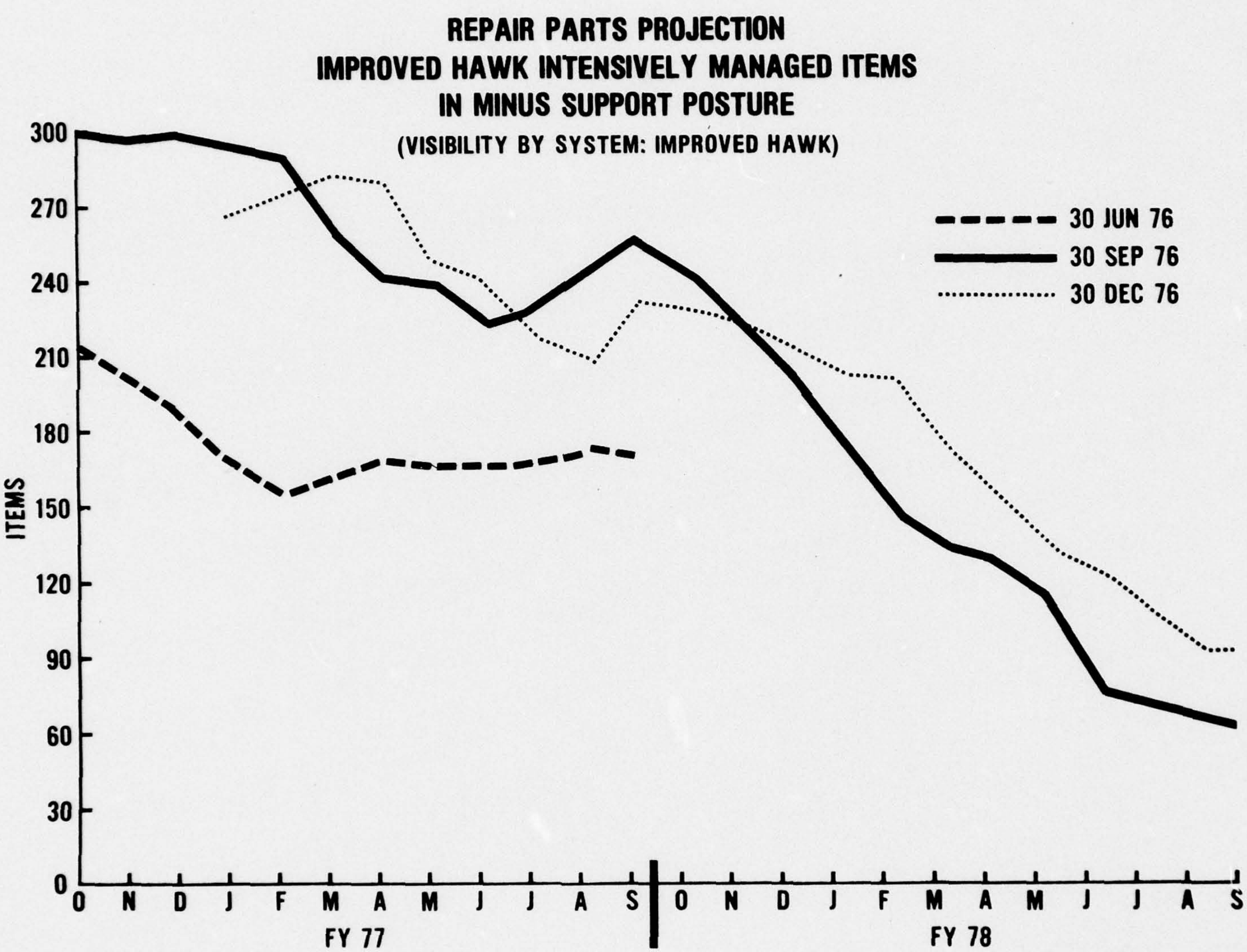
REPAIR PARTS PROJECTION
IMPROVED HAWK INTENSIVELY MANAGED ITEMS
IN MINUS SUPPORT POSTURE
(VISIBILITY BY SYSTEM: IMPROVED HAWK)
30 JUN 76
30 SEP 76
30 DEC 76
ITEMS
300
270
240
210
180
150
120
90
60
30
0
O N D J F M A M J J A S O N D J F M A M J J A S
FY 77
FY 78

Figure B-1-7

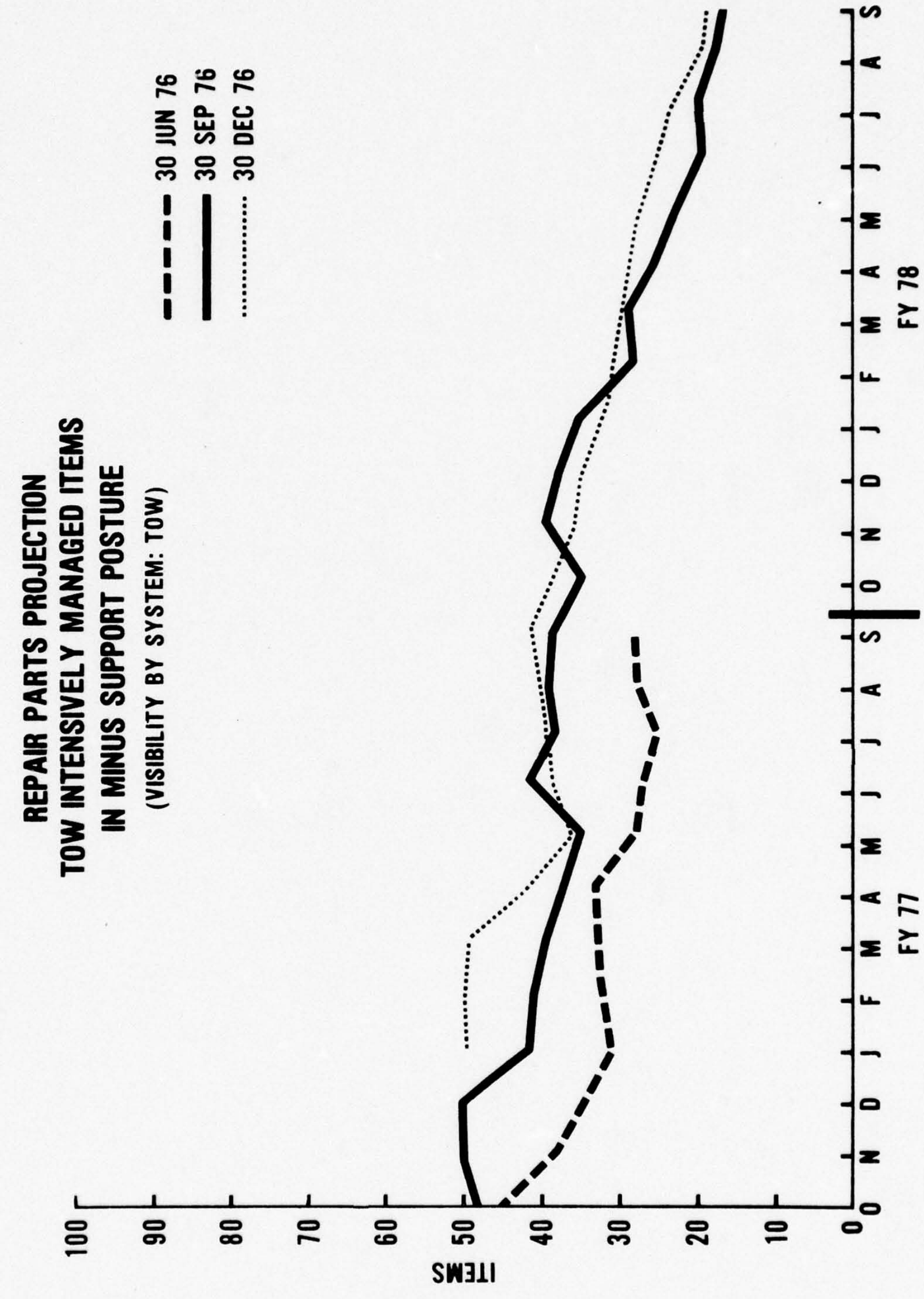

Figure B-1-8

LAST PAGE OF APPENDIX B-1

APPENDIX B-2

INDUSTRY APPRAISAL

1. Purpose. This appendix provides a general overview and appraisal of selected US industrial sectors that contribute to or are responsible for producing manufactured items critical to the US Army. As such, the appendix provides a basis for evaluating the industrial sector appraisal done by the MSCs.

2. Scope. Within the scope of this appendix the following subjects are covered:

a. Nineteen industrial sectors are selected for review and analysis.

b. Problems within the industrial sectors are identified (e.g., labor unrest, migration of industries overseas, and raw material).

c. Historical trends in the industrial sectors are summarized to gain perspectives of the industrial sectors and note problems, particularly recurrent ones.

d. Future trends in some industrial indicators are projected over the 1976-1985 time period for the industrial sectors to permit a general appraisal of industrial capability to meet future demands.

e. Finally, an overall evaluation of US industry in terms of the selected sectors is made to determine how well the US industrial base can support US Army and foreign requirements.

3. Industrial Sectors Appraised.

a. Sectors. There are a number of ways to break out industrial sectors for analysis. The APOM focuses on seven major industrial areas, namely: aircraft, missiles, ammunition, weapons, electronics, mobility, and combat vehicles. The Leontief input-output analysis model used by the Department of Commerce and various economists considers 99 industrial sectors. In producing their annual US Industrial Outlook publication, the Department of Commerce uses 182 industrial sectors corresponding to selected SIC codes. Even this listing is limited, since Department of Commerce analysts monitor over 500 SIC codes. For this appraisal, 19 industrial sectors were selected, each defined by one or more SIC codes. The sectors selected contribute substantially to Army requirements, either in gross volume or importance of item in highly technical equipment. These selected industrial sectors are shown in Figure B-2-1.

b. Sources. To accomplish this study, ESG relied primarily upon statistics maintained by the Departments of Commerce and Labor, and discussions with industrial analysts in these departments who monitor the selected industrial sectors. Considerable assistance was provided by industrial analysts in the Department of Commerce's Office of Business Research and Analysis (OBRA). Previous ESG work on industrial projections was also used. In addition, DA elements involved in preparing the industrial capacity assessment for the POM were contacted. The POM data while oriented exclusively toward military requirements look primarily to the problem of increasing military item production under mobilization conditions. In this study, the evaluation is of peacetime industrial production and, therefore, must appraise total industry sector trends and problems rather than restricting the appraisal to the military segment of the industrial sector.

4. Indicators of Industrial Viability. In evaluating the 19 industrial sectors, four indicators of industrial viability were selected as the basis for charting past performance and projecting future trends.

INDUSTRIAL SECTORS APPRAISED

Industries	SIC Codes
Rubber and Miscellaneous Plastics Products	
Tires and Inner Tubes	3011
Hose and Belting	3041
Synthetic Rubber	2822
Motor Vehicles	
Automobiles	3711
Truck Trailers	3715
Truck and Bus Bodies	3713
Truck and Bus Chassis	37112, 37113
Aerospace	
Aircraft	3721
Aircraft Engines, Parts and Space Propulsion Units and Parts	3724, 3764
Guided Missiles, Space Vehicles and Equipment	3761, 3769
Electronic Equipment and Components	
Consumer Electronics	3651
Electronic Systems and Equipment	3662
Electronic Components	367
Computing and Calculating Equipment	
Computers and Related Equipment	3573
Telephone and Telegraph	
Telephone and Telegraph Equipment	3661
Instruments for Measurement, Analysis and Control	
Engineering and Scientific Instruments	3811
Measuring and Controlling Instruments	3821[a/]
Optical Instruments and Lenses	3832
General Machinery Components	
Ball and Roller Bearings	3562

a/ 3821, Measuring and Controlling Instruments is composed of four industrial sectors: 3822, Automatic Control; 3823, Measurement and Control Instruments; 3824, Meters and Counting Devices; and 3829, Measurement and Control Devices not elsewhere classified.

Figure B-2-1

Data availability and projection limitations varied according to indicator, but together they provide a composite picture of the status and projected health of each sector. The four indicators used and the basic statistics were:

a. Value of product shipped. This indicator is a primary one in that for all industry sectors examined it is possible to determine and project the value of the product manufactured and shipped from 1967 through 1985. Ideally, the values for all industrial products should be in terms of constant dollars, using 1967 as the base year. This is possible in 9 of the 19 industrial sectors examined, but in the other 10 it was necessary to use current year dollars. There were changes in SIC codes during the periods covered, and some SIC codes were not included at all in the Department of Labor's wholesale price index listing. Since inflationary rates are not the same in all industries, it is not possible to use a standard factor for converting current year dollars to 1967 dollars. For projections beyond 1976, however, all dollars are either in 1967 dollars or 1976 dollars depending on whether the 1967 dollar base is used for pre-1976 years. The value of products shipped for the years 1975 and 1976 are estimates since there is a lag between data acquisition, aggregation, and compilation by the Bureau of Domestic Commerce. These estimates, however, appear well founded based on comparisons between previous estimates and actual figures. Figure B-2-2 shows the value of products shipped for the period 1967-1975, and Figure B-2-3 shows the value of products estimated to be shipped for the period 1976-1985.

INDUSTRIAL PRODUCTION TRENDS IN US INDUSTRY: 1967-1975
(In Millions of 1967 Dollars, Except As Noted, Based on Value of Product Shipped)

SIC Codes	Industry	1967	1970	1971	1972	1973	1974	1975a/
	Rubber & Miscellaneous Plastics							
3011	Tires & Inner Tubes	3,134	3,581	3,979	4,436	4,873	4,091	3,180
3041	Hose & Belting b/	622	756	780	886	948	1,235	1,250
2822	Synthetic Rubber	1,005	1,160	1,144	1,256	1,368	1,290	906
	Motor Vehicles							
3711	Automobiles	19,277	18,111	25,062	23,982	26,953	19,255	15,235
3715	Truck Trailers	702	574	519	851	1,000	1,006	381
3713	Truck & Bus Bodies b/	595	NVAL	NVAL	1,369	NVAL	1,398	1,200
37112, 37113	Truck & Bus Chassis	3,454	5,283	5,942	6,936	8,173	8,211	6,717
	Aerospace							
3721	Aircraft b/	9,172	9,690	7,913	8,361	9,964	10,502	11,774
3724, 3764	Acft Engines, Parts & Space Propulsion Units b/	4,814	4,594	3,759	3,810	4,557	4,919	5,192
3761, 3769	Guided Missiles, Space Vehicles, & Equipment b/	5,445	3,770	3,575	4,991	4,953	5,205	5,667
	Electronic Equipment & Components							
3651	Consumer Electronics	3,217	3,165	3,500	3,874	4,995	4,211	3,642
3662	Electronic Systems & Equipment	7,482	8,454	7,995	8,377	9,253	9,549	10,170
367	Electronic Components	5,990	5,736	5,233	7,253	10,037	9,599	8,404
	Computing & Calculating Equipment							
3573	Computers & Related Equipment	4,049	5,722	5,334	6,169	7,324	8,512	8,745
	Telephone & Telegraph							
3661	Telephone & Telegraph Equipment b/	2,248	3,575	3,708	3,973	4,427	4,883	4,489
	Instruments for Measurement, Analysis, & Control							
3811	Engineering & Scientific Instruments b/	1,049	1,216	1,111	1,106	1,304	1,456	1,724
3821	Measuring & Controlling Instruments b/	1,893	1,953	2,016	2,365	2,830	3,225	3,162
3832	Optical Instruments & Lenses b/	559	578	463	585	650	846	930
	General Machinery Components							
3562	Ball & Roller Bearings	1,161	1,066	980	1,091	1,204	1,010	650

Sources: (7)(8)
a/ Estimated by Bureau of Domestic Commerce.
b/ In millions of current year dollars; records on inflationary rates not maintained for these SIC codes by BLS.

Figure B-2-2

INDUSTRIAL PRODUCTION TRENDS IN US INDUSTRY: 1976-1985
(In Millions of 1967 Dollars, Except As Noted, Based on Value of Product to be Shipped)

SIC Codes	Industry	1976a/	1977b/	1978b/	1979b/	1980b/	1982b/	1985b/
	Rubber & Miscellaneous Plastics							
3011	Tires & Inner Tubes	3,040	3,210	3,380	3,570	3,770	4,190	4,920
3041	Hose & Belting c/	1,375	1,580	1,680	1,790	1,910	2,170	2,630
2822	Synthetic Rubber	956	1,000	1,050	1,110	1,160	1,280	1,480
	Motor Vehicles							
3711	Automobiles	17,677	18,320	19,000	19,700	20,430	21,970	24,500
3715	Truck Trailers	419	460	510	560	620	750	990
3713	Truck & Bus Bodies c/	1,400	1,500	1,560	1,620	1,690	1,820	2,050
37112, 37113	Truck & Bus Chassis	6,089	6,326	6,573	6,829	7,095	7,660	8,691
	Aerospace							
3721	Aircraft c/	11,122	11,450	11,830	12,220	12,620	13,470	14,840
3724, 3764	Acft Engines, Parts & Space Propulsion Units c/	5,070	5,290	5,560	5,850	6,140	6,790	7,910
3761, 3769	Guided Missiles, Space Vehicles, & Equipment c/	4,768	5,410	5,900	6,430	7,010	8,380	10,780
	Electronic Equipment & Components							
3651	Consumer Electronics	3,946	4,010	4,080	4,150	4,220	4,370	4,590
3662	Electronic Systems & Equipment	10,700	11,000	11,680	12,410	13,180	14,860	17,800
367	Electronic Components	9,470	10,100	10,780	11,500	12,270	13,970	16,970
	Computing & Calculating Equipment							
3573	Computers & Related Equipment	10,100	10,900	11,770	12,720	13,730	16,020	20,180
	Telephone & Telegraph							
3661	Telephone & Telegraph Equipment c/	4,714	5,040	5,360	5,690	6,040	6,820	8,160
	Instruments for Measurement, Analysis, & Control							
3811	Engineering & Scientific Instruments c/	1,838	1,900	2,110	2,340	2,590	3,190	4,350
3821	Measuring & Controlling Instruments c/	3,470	3,850	4,270	4,740	5,270	6,490	8,870
3832	Optical Instruments & Lenses c/	1,079	1,300	1,440	1,590	1,770	2,170	2,970
	General Machinery Components							
3562	Ball & Roller Bearings	544	590	640	690	740	860	1,080

Source: (8)
a/ Estimated by Bureau of Domestic Commerce.
b/ Projected changes, 1977-1985, provided by Office of Business Research and Analysis.
c/ In millions of 1976 dollars; records on inflationary rates in these sectors not maintained by Bureau of Labor Statistics (BLS).

Figure B-2-3

b. Employment trends. The number of employees in an industrial sector over a number of years provides an indication of industrial growth or shrinkage. Alone, employment trend figures are not absolute indicators for several reasons. First, some industries are highly volatile in terms of employment, and the numbers employed can vary widely within even one year. Second, an industry can be expanding, but employment remains constant or even is cut back because technological advances provide more efficient and less labor-intensive means of producing the product. Third, employment is the first indicator to show a decline in a recession period, although industrial plant capability may remain unchanged or even expand in anticipation of improved economic conditions. Employment trends for most industrial sectors are considered for the period 1967-1976. In some cases, projections are possible for 1977, but the Bureau of Census does not try to project employment beyond 1977 because of the many variables and uncertainties involved in making such projections. Taken in context with other indicators, employment trends do provide an indication of industry sector health. Figure B-2-4 shows the employment trends for the period 1967-1977.

c. Number of production units. Like employment trends, trends in the number of producing units within an industrial sector are an indicator only if taken in context with other indicators and consideration is given to the dynamics within the sector. An expansion or shrinkage in the number of producing units can be the result of new technology making many

EMPLOYMENT TRENDS IN US INDUSTRY: 1967-1977
(In Thousands of Total Employees)

SIC Codes	Industry	1967	1970	1971	1972	1973	1974	1975	1976	1977
	Rubber & Miscellaneous Plastics									
3011	Tires & Inner Tubes	93	103	105	105	115	117	105	92	NAVL
3041	Hose & Belting	a/	a/	a/	32	30	31	30	32	33
2822	Synthetic Rubber	13	13	12	12	11	12	11	12	12
	Motor Vehicles									
3711	Automobiles	221	a/	a/	236	259	233	204	225	235
3715	Truck Trailers	23	23	22	25	28	31	18	21	NAVL
3713	Truck & Bus Bodies	a/	a/	a/	a/	a/	44	a/	39	NAVL
37112, 37113	Truck & Bus Chassis	71	77	79	81	83	85.1	70	72	NAVL
	Aerospace									
3721	Aircraft	387	320	238	232	239	239	232	220	213
3724, 3764	Acft Engines, Parts & Space Propulsion Units	195	165	141	126	137	137	130	122	118
3761, 3769	Guided Missiles, Space Vehicles, & Equipment	201	143	132	139	138	133	132	127	128
	Electronic Equipment & Components									
3651	Consumer Electronics	117	90	90	87	92	88	72	76	NAVL
3662	Electronic Systems & Equipment	410	390	325	319	323	318	316	316	316
367	Electronic Components	403	360	311	335	395	382	340	355	370
	Computing & Calculating Equipment									
3573	Computers & Related Equipment	99	153	135	145	157	176	174	176	NAVL
	Telephone & Telegraph									
3661	Telephone & Telegraph Equipment	115	142	140	135	138	145	131	129	129
	Instruments for Measurement, Analysis, & Control									
3811	Engineering & Scientific Instruments	46	51	44	37	41	46	45	44	NAVL
3821	Measuring & Controlling Instruments	104	109	98	100	103	111	101	104	109
3832	Optical Instruments & Lenses	21	21	17	19	19	20	19	20	20
	General Machinery Components									
3562	Ball & Roller Bearings	59	56	48	51	54	55	52	53	54

Sources: (7)(8)
NOTE: 1976 and 1977 figures are estimates by the Bureau of Domestic Commerce.
a/ Figures for these years unavailable because of changes in industrial sector and SIC codes breakout.

Figure B-2-4

small units economically feasible or consolidation of small units more viable, economic recession forcing marginal producers out of business, availability of risk capital, or some other variable in the marketplace. No recent accurate census of the number of production units by industrial sector is available, since such censuses are made only every 10 years. Reasonable estimates of the number of units have been made by OBRA for the years 1974 and 1976 (see Figure B-2-5). The number of producing units is primarily of interest in terms of how many potential suppliers there are, and will be, for meeting military requirements.

d. Capital expenditures. Capital expenditures by industry for new plant and capital equipment serve as indicators of overall economic health and may indicate industry sector expansion, plant and facility modernization, and/or development of new technologies. A constant or downward trend in capital expenditures is indicative of falling markets, low profit margins, or reluctance to invest because portents are for a sagging economy. Thus the capital expenditures, along with the value of product shipped, are key indicators for estimating industrial viability. Data on capital expenditures by industrial sectors are shown in Figure B-2-6. These data are limited to the period 1967-1974, since later data are not compiled and projections in the area of capital expenditures are very uncertain; too many variables affect the amount of major resources industry is willing to commit very far in advance. But, even historical trends are useful in determining the future outlook for industrial sectors, and in some cases broad estimates of future capital expenditures are possible.

PRODUCTION UNITS IN US INDUSTRY: 1974 AND 1976

SIC Codes	Industry	1974[a/]	1976[a/]
	Rubber & Miscellaneous Plastics		
3011	Tire & Inner Tubes	210	200
3041	Hose & Belting	95	100
2822	Synthetic Rubber	60	60
	Motor Vehicles		
3711	Automobiles	231	231
3715	Truck Trailers	250	227
3713	Truck & Bus Bodies	780	705
37112, 37113	Truck & Bus Chassis	30	28
	Aerospace		
3721	Aircraft		
3724, 3764	Acft Engines, Parts & Space Propulsion Units	1,225	1,170
3761, 3769	Guided Missiles, Space Vehicles & Equipment		
	Electronic Equipment & Components		
3651	Consumer Electronics	81	400
3662	Electronic Systems & Equipment	867	1,770
367	Electronic Components	1,450	2,800
	Computing & Calculating Equipment		
3573	Computers & Related Equipment	610	601
	Telephone & Telegraph		
3661	Telephone & Telegraph Equipment	200	200
	Instruments for Measurement, Analysis & Control		
3811	Engineering & Scientific Instruments	721	743
3821	Measuring & Controlling Instruments	1,000	979
3832	Optical Instruments & Lenses	482	491
	General Machinery Components		
3562	Ball & Roller Bearings	NAVL	94

a/ Estimates made by Bureau of Census.

Figure B-2-5

CAPITAL EXPENDITURE TRENDS IN US INDUSTRY: 1967-1974
(In Millions of Current Year Dollars)

SIC Codes	Industry	1967	1970	1971	1972	1973	1974
	Rubber & Miscellaneous Plastics						
3011	Tires & Inner Tubes	198.8	271.6	219.5	267.1	374.3	486.3
3041	Hose & Belting[a]	134.6	122.9	92.8	31.6	33.2	71.7
2822	Synthetic Rubber	75.2	49.5	49.0	35.5	46.1	57.2
	Motor Vehicles						
3711	Automobiles	263.2	336.2	315.5	917.2	805.9	1,042.9
3715	Truck Trailers	22.3	19.7	20.2	14.6	28.0	29.7
3713	Truck & Bus Bodies	13.0	19.0	21.2	48.3	29.5	34.5
37112, 37113	Truck & Bus Chassis[b]						
	Aerospace						
3721	Aircraft	408.2	181.4	59.2	57.1	119.9	111.0
3724, 3764	Acft Engines, Parts & Space Propulsion Units[c]	--	--	--	91.4	103.2	126.2
3761, 3769	Guided Missiles, Space Vehicles, & Equipment[c]	--	--	--	73.9	88.0	102.5
	Electronic Equipment & Components						
3651	Consumer Electronics	86.1	51.0	36.4	58.6	79.6	104.5
3662	Electronic Systems & Equipment	246.0	254.7	191.4	212.2	228.9	270.0
367	Electronic Components	373.3	358.3	337.5	343.5	628.0	785.3
	Computing & Calculating Equipment						
3573	Computers & Related Equipment	117.1	294.5	245.6	212.8	213.0	296.0
	Telephone & Telegraph						
3661	Telephone & Telegraph Equipment	110.9	118.0	216.2	169.2	213.8	201.7
	Instruments for Measurement, Analysis, & Control						
3811	Engineering & Scientific Instruments	21.8	22.3	25.3	18.8	28.3	41.0
3821	Measuring & Controlling Instruments	58.3	56.6	44.3	66.1	91.9	97.2
3832	Optical Instruments & Lenses	15.8	11.4	7.8	12.7	13.6	15.3
	General Machinery Components						
3562	Ball & Roller Bearings	107.1	54.9	86.7	51.3	73.1	73.1

Sources: (5)(6)
a/ Hose and belting aggregated with other fabricated products for years 1967-1971.
b/ Capital expenditures not recorded for this SIC code.
c/ Capital expenditure records not maintained for these SIC codes prior to 1972.

Figure B-2-6

5. Industrial Sector Appraisal. As indicated in the preceding figures, the 19 industrial sectors evaluated in this annex can be grouped into 8 major industrial areas. The following appraisal is based on these 8 industrial areas, although within the areas the individual industrial sectors are appraised where trends depart from the norm for the area, where special problems exist, or where special consideration is warranted.

a. Rubber and miscellaneous plastics. This industrial area provides a major input of products into other manufacturing areas which in turn directly support military procurement as well as providing end products. In 1963, the last peacetime year for which there are definitive input-output data, 23 percent of the products from the total rubber and plastics industrial area went into motor vehicles of all types, and 7 percent of motor vehicles went to Defense. (7) While the percentage increased during the Vietnam War period, current percentages probably have dropped to about the 1963 level or slightly below. With the trend toward lighter vehicles in all classes, a much higher percentage of rubber and plastics products are expected to be going into vehicles by 1985. For the industrial area overall, capital expenditures, in real terms, declined during 1975 after a consistent upward trend, but are expected to show a resurgence in growth during 1976. Overall, the area appears destined to expand consistently through 1985 as the national economy recovers from the 1974-1975 recession. For individual sectors within the area the outlook is mixed.

(1) Tires and inner tubes. This sector suffered a major decline in product output resulting from the drop in automobile sales in 1974-1975. Additionally, it was hard hit by the rubber strike in 1976. Some recovery is expected over the 1977-1985 period, but recovery will not be rapid and the industry does face some problems. Of these problems, the major ones could be continued labor unrest when new contracts will have to be negotiated in 1979, 1982, and 1985; the large amount of capital investment required annually to keep up with developing technologies; the large amount of petroleum products required in the manufacture of new tires; and the depression of demand resulting from lighter automobiles and the development of new longer wearing radial tires. (8) These problems combined have had the effect of driving marginal companies out of business or into consolidation with larger companies, and the trend is expected to continue. Imports have made some inroads into the US market, but are not expected to be a significant factor in the time period of this study. Despite adversities within the industry, it should be able to fill military demands with no problem unless there are excessively long strikes during contract renegotiation years.

(2) Hose and belting. This is the fastest growing sector of the rubber and plastics industrial area. The need for more and specialized belts and hoses is increasing rapidly as machinery becomes more complex and specialized. (8) Every indication is that the demand and resultant growth will continue through the study time period. Although dependent to a large extent on the availability of petroleum, there appears to be no foreseeable shortages in hose and belting products.

(3) Synthetic rubber. Although this industrial sector appears to have recovered from its 1975 recession, continued growth probably will be very slow. Two elements contribute to slow growth. The industry is highly dependent on the availability of petroleum, and there is a trend in shifting to lighter weight plastic products and plastics capable of more diversified use. (8) This may be the weakest sector in the rubber and plastics products area.

b. Motor vehicles. This industrial area covers several individual sectors. In 1963, 7 percent of the industry's product went to Defense, and an estimate today is that probably a somewhat smaller percentage goes to Defense. (7) The industry was hard hit by the 1974-1975 recession and the dramatic fall-off of vehicle purchases. The entire industry showed a significant improvement in 1976, and the trend is expected to continue through 1985. There is a trend toward lighter weight vehicles as a fuel economy measure. This includes the trend toward smaller automobiles despite a temporary consumer preference for larger automobiles. In the trucking industry, the trend is toward larger bodies and chassis, but use of new materials may keep weights down. The trucking industry should experience rapid growth over the next 2-3 years with a high replacement demand expected. (8) Capital investment has continued high despite the recession period. This is due in part to model changes and trends toward fuel-saving features, but it also appears that the industry has been building for the future with the expectation of increased volume and plant production capability. Military procurement of end items and parts from this industrial area should face no problems resulting from a lack of plant production capability, since such capability should exceed total demand through the study time period.

c. Aerospace. The aerospace industry is one of the most unstable in terms of expansion and shrinkage of any industry. A variety of factors influence this industry. More than most industries, the aerospace industrial area is highly dependent on military orders. Within recent years, the industry also has been restricted in terms of civilian orders, by air and sound pollution controls on new aircraft, and the declining availability of petroleum, and consequent reluctance of airlines to make new large investments. Of long-range concern is the rapidly declining amount of petroleum, and the fact that US reserves may be exhausted in 10 years. Thus the industry faces a precarious and uncertain future. The entire industry has suffered in the last few years, but there are indications for short-term recovery, at least in the aircraft portion of the industry. Capital investments have not kept pace in aerospace with other industries, since design changes for new vehicles require a long leadtime. Thus, the latest technologies in manufacturing are not incorporated into manufacturing plants. In fact, all manufacturers except Boeing Aircraft are currently having difficulty in keeping facilities intact. (8) A major factor in keeping the industry going are exports, which in 1977 are expected to account for 45 percent of the industry's output and form the basis for about 170,000 jobs. (8) In looking at individual sectors of the industry, the trends appear similar throughout.

(1) Aircraft. The major industrial sector of the aerospace industrial area is in aircraft manufacture. Here the dependence on military orders is clear. In 1963, 71 percent of the industry's product, by value, went to the military. (7) This has dropped since then. Current military orders are running about 11 percent of units produced. Much of this is attributable to the rapid rise in general aviation over the past decade and a half, so that a large number of small private aircraft are now being produced. At the same time, based on value, military orders account for nearly 50 percent of the aircraft orders. (8) The estimated future growth trend expressed in value of product shipped (Figure B-2-2) is somewhat misleading, since the dollar values are available only in current year dollars. Considering inflation, the product value actually dropped from 1974-1976. Better indications of trends can be found in employment trends (Figure B-2-4) and number of plants (Figure B-2-5). This industry needs to be carefully watched in terms of its economic health in coming years, particularly with foreign competition becoming more intense.

(2) Aircraft engines and parts, and space propulsion units and parts. This industrial sector is a necessary supporting sector for the aircraft industry. Again, it relies heavily on military expenditures.

In 1963, the percent of the product going to Defense ranged between 38 and 68 percent, depending on the part. (7) These percentages have dropped since 1963, but in value they remain essentially in the same proportion as do aircraft. The industry's growth trend parallels that of the aircraft industry, as might be expected, and the future will be dependent on how well the latter industry fares.

(3) Guided missiles, space vehicles, and equipment. This industrial sector is totally dependent on government purchases. In 1963, 70 percent of the product went to Defense and 30 percent to other government agencies, primarily NASA. (7) The percent going to Defense has undoubtedly increased now that the space program has been significantly reduced. Between 1967 and 1971, the industry experienced about a 55 percent reduction in product output, primarily the result of the space program's curtailment. Since 1971, the industry has grown (except for a decline in 1976), although slowly in recent years. Much of the growth is attributable to increased military (including foreign) orders for guided missiles of various types and their parts. This growth is expected to continue through 1985, and plant capacity should be available to meet all requirements.

d. Electronic equipment and components. The electronics industrial area is nearly as unstable as the aerospace industry in terms of expansion and shrinkage, but each sector within the general area appears subject to different variables. Overall, in 1963, 60 percent of the radio and TV communication equipment went to Defense. (7) As the military develops and fields more sophisticated weapon systems, certain portions of the electronics area probably will become even more reliant on Defense purchases, at least indirectly since electronic components are usually not end items in themselves, but are essential parts of weapon systems. Three principal sectors of the electronics area illustrate the trends in the area.

(1) Consumer electronics. This industrial sector includes radios and televisions, and generally is associated with the retail electronics market. The trend in products shipped follows, to a large degree, the overall consumer market, with a steady rise through 1973, then a sharp drop during 1974 and 1975. Some recovery is expected in 1976 followed by a gradual increase through 1985. In 1973, 15 percent of the components going into consumer electronic products were manufactured in US-owned plants overseas, primarily Asia, and this percentage is expected to increase through the foreseeable future. (8) Lower labor costs are the primary reason for this transfer of manufacturing functions overseas, but this does leave the industry vulnerable to international situations. At the same time, 45 percent of consumer electronics sold in the US were imports in 1973, and this percentage is increasing. (8) The competition of foreign imports has forced US manufacturers to sell with low profit margins, which has kept capital investment relatively low. Despite the inroads of foreign competition, there was a near 400 percent increase in the number of producing units in this sector between

1974 and 1976. Primarily this reflects the upturn in the economy. However, many of the new producers are small operations, and any downturn in the economy probably would force many out of business.

(2) Electronic systems and equipment. This industrial sector is less vulnerable to the consumer economy than the previous sector, since the majority of the products are sold to Defense as components of sophisticated weapon systems. The slight downturn in the product value shown in Figure B-2-2 for 1971 is largely the result of cutbacks in new Defense orders. With continued high Defense spending and the trend to even more sophisticated weapon systems, this industrial sector should show continued growth through 1985. Capital investment has remained relatively high, indicating continued adequate plant and equipment capacity to meet all requirements.

(3) Electronic components. The electronic component sector is highly sensitive to technological developments. The sector is also highly dependent on other industries for markets. Fluctuations in output reflect the variable market in computer equipment, calculators, aerospace, and others. A good portion of the product goes into export, particularly the export of semiconductors. A steady growth in this industrial sector is expected through 1985 with no deficiencies in facilities. The major problem in this sector is keeping pace with demands for new technology, and the consequent retooling that is required when a technological breakthrough is experienced.

e. Computers and related equipment. In 1963, 12 percent of the computer-related equipment industry's product went to Defense, and estimates are that this percentage has increased slightly since then. (7) The industry has shown a consistent growth pattern as illustrated in Figure B-2-3 with only one slight downturn in 1971. Consistent growth is expected through 1985. The industry appears relatively stable with sound capital investment trends to assure continued plant capacity to meet all requirements. Basically, the bright future for this industry is the result of rapid technological advances in the industry which in turn permit broader application throughout industry, thus saving in manpower and related costs. The rapid rise of minicomputers and a general price reduction in 1975-1976 also have given added impetus to industry expansion. No major problems are foreseen for this industry. The Japanese computer industry appears to be making a challenge, but the Japanese are not expected to make any significant inroads into the US markets. (8)

f. Telephone and telegraph equipment. This industrial sector, vital for communications, has been hard hit by the recession of 1974-1976, although Figure B-2-3 shows a recovery in 1976. If measured in 1975 dollars, however, the 1976 product value is even lower than 1975; in short, a 5 percent increase in 1976 was wiped out by inflation. (8) A slow but steady recovery of the industry is expected from 1977 through 1985. Much of the expansion in this industry in the past has been a result of new homes and building starts. Within the last year or so, however, a rapidly growing portion of the product is being exported. This trend should continue through 1985 as foreign areas, particularly Middle East countries, install more efficient communication systems.

g. Instruments for measurement, analysis, and control. This industrial area can be subdivided into seven industrial sectors, and four of these can be combined into one sector. Three sectors are considered in this study, one of which is the combined sector, to typify the area overall. Generally, this industrial area has shown consistent growth with some fall-off during the 1971 to 1974 period, reflecting reduced Defense spending and the recession period. Capital investment has been consistent through the period reviewed and in line with profits. Overall, the industrial area appears in good health with good growth potential. Despite this, there are some weak spots that will be discussed under the industry sectors described below.

(1) Engineering and scientific instruments. In 1963, 33 percent of the products from this sector went to Defense. (7) This had dropped since 1963, since a large increment (50 percent) of these products went into military aircraft. With the fall-off in aircraft orders, there has been a resultant reduction in the Defense increment of this industry's product. There has been compensation, however, in that exports have increased considerably in the last few years, more than offsetting the loss of Defense orders. The export market appears to be steadily increasing and should hold strong through 1985.

(2) Measuring and controlling instruments. This industry sector can be subdivided into four other sectors, as noted in Figure B-2-1, but for convenience are combined in this study. Figures B-2-2 and B-2-3 show that after a fall-off in demand for products in the 1974-1975 period, the industry recovered in 1976 and is expected to grow fairly rapidly through 1985. One major portion of this industry is the sighting and fire control sector, which in 1963 had some 94 percent of its product going to Defense. (7) This sector has declined contrary to trends in the overall sector as military purchases decline because the military is going increasingly to electronic guidance systems. In the electric measuring instruments sector, some 18 percent of the product went to Defense in 1963. (7) Offsetting declines from Defense purchases has been a rather sizable increase in exports, which is expected to continue increasing for the foreseeable future.

(3) Optical instruments and lenses. This sector has been the slowest growing of the sectors in this industrial area. In fact, the US has continually had a trade deficit in this sector. This is expected to change in 1977, resulting in accelerated growth for the sector. In 1963, 9 percent of optical instruments and lenses went into sighting and fire control instruments. (7) The decline in military purchases of the latter has had an adverse effect on optics, but if expectations in terms of exports are realized, the industry sector should show continued growth. Otherwise this will remain one of the weak sectors in the instrument area.

h. Ball and roller bearings. Antifriction bearings are key components in a variety of machinery. For the industrial sectors considered in this appendix, the primary areas requiring bearings are motor vehicles and aerospace products. Since the antifriction bearing industry is heavily dependent on the motor vehicle and aerospace industries as markets, the bearing industry's product sales parallel those of the other two industries. Fluctuations in bearing sales between 1967 and 1985 generally follow overall economic trends. However, the bearing industry shows about a year's lag time from that of other industries. This indicator provides an insight to the most pressing problem in the bearing industry, namely the long leadtime required for the industry to meet orders. In the past, the time between placement of substantial orders and delivery has been about one year. This can be attributed largely to limited plant capacity and a growing need for antifriction bearings. One factor that has limited plant capacity expansion is the increasing competition from abroad. In 1974, foreign imports accounted for 12 percent of the bearings used in the US, and in 1976 imports accounted for 10.7 percent. (8) While these percentages are not high, US manufacturers have prevented further inroads by maintaining low profit margins which in turn has prevented necessary capital expenditures for plant expansion. The situation shows signs of improvement because of greater sales potential (an increase in farm machinery production is compensating for the decline in motor vehicle and aerospace) and gradual expansion in plant capacity. In 1976, the bearing industry was able to cut the time between orders and shipments to less than 6 months, and further improvements are expected in the next few years. Capital expenditures are still low, but there is some gradual expansion in facilities. Sales are expected to increase through 1985, but the increase will be slow. While the bearing industry appears capable of meeting all requirements, considerable advance planning will be needed for the next few years to take account of long leadtime.

6. Evaluation and Appraisal.

a. Summary. A summary evaluation (+, -, or 0) for each of the 19 sectors and each of the 4 indicators is shown at Figure B-2-7. A negative (-) value for an indicator illustrates a decreasing trend of that specific industrial sector. A zero (0) value indicates no change, while a positive (+) value indicates an increasing trend for that sector. The last column of Figure B-2-7 subjectively evaluates this historical information and predicts a trend for the value of production over the years 1976 to 1985. The future appraisals of the industrial sectors generally indicate a continued growth in every sector. These favorable projections stem in part from the reduced level of inflation in 1976 and some recovery in most industries from the 1974-1975 recession. There are some weak spots in the industrial sectors examined, notably in the aerospace area and some electronics and instrument sectors. However, overall

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SECTOR EVALUATION AND APPRAISAL

	Indicators				
Sectors	Value of Product Shipped (1967-1975)	Employment (1967-1975)	Number of Producers (1974 & 1976)	Capital Expenditures (1967-1975)	Value of Product Shipped (1976-1985)
Rubber					
Tires and Inner Tubes	-	-	-	+	+
Hose and Belting	+	+	+	NA	+
Synthetic Rubber	-	+	0	-	+
Motor Vehicles					
Automobiles	-	+	+	+	+
Truck Trailers	-	-	-	+	+
Truck and Bus Bodies	+	-	-	+	+
Truck and Bus Chassis	+	-	-	NA	+
Aerospace					
Aircraft	+	-	-	-	+
Aircraft Engines	+	-	-	+	+
Guided Missiles	+	-	-	+	+
Electronics					
Consumer Electronics	+	-	+	+	+
Electronic Systems and Equipment	+	-	+	+	+
Electronic Components	+	-	+	+	+
Computing and Calculating Equipment					
Computers	+	+	-	+	+
Telephone and Telegraph					
Telephone and Telegraph Equipment	+	+	0	+	+
Instruments for Measure, Analysis, and Control					
Engineer and Scientific	+	Unk	+	+	+
Measure and Controlling	+	Unk	-	+	+
Optical and Lenses	+	Unk	+	0	+
General Machinery					
Ball and Roller Bearings	-	-	NA	-	+

Figure B-2-7

the picture appears bright for continued US industrial stability and growth. This would indicate that military requirements can be met without any problem resulting from inadequate industrial production capacity.

b. Optimum. The question must be asked, however, if the projections made for these industrial sectors are not overly optimistic. Projections are made on the basis of recent experience and trends, and reflect the short-range views (which in the industrial sectors are the only ones possible with any degree of certainty) of industrial analysts. When projections are made up to 9 years in advance, there are many factors that are not, and probably cannot, be taken into consideration without developing a broad set of projections for each industrial sector. Thus, the trends of the last few years, basically recession and recovery, are projected in a virtual straight-line fashion. Yet, some factors should be considered in using the projections.

(1) Technology. One factor that cannot be predicted, but should be kept in mind as a possible influence on the projections, is the effect that a major technological breakthrough in one area would have. In general, any major technological development would accelerate industrial growth and/or open up new industrial areas. The development of microcircuitry and its effect on electronics and computers is an example of this. Should a major breakthrough develop in the energy field, the influence on all industrial sectors would be profound. But technological developments are not always unmixed blessings. The developments in

electronics, for example, have led to the use of electronic guidance systems and a consequent reduction in the use of optical systems. This has depressed the optics industry which, without projected exports, would be on a declining trend. Yet optics still serve a useful purpose to the military. Thus, technological changes must be evaluated on an industry by industry basis to ascertain how that will affect industry overall.

(2) Raw materials. Another factor that must constantly be weighed in a period of declining resources is the possible shortage of critical materials. For the industrial sectors considered in this appendix, the most critical material is petroleum. Petroleum derivatives are basic to the rubber and plastics industrial area, and petroleum availability is key to the continued health of the motor vehicles and aerospace industrial areas. In turn, both the electronics and instrument industrial areas rely heavily on the preceding two for their markets. Since petroleum is becoming an increasingly scarce resource, the continued viability of all these industrial areas remains questionable. How soon petroleum resources will be exhausted is questionable and dependent on such things as conservation measures, development of other energy sources, and population growth. But the fact remains that petroleum reserves in the US probably will be exhausted in the the near future and other world reserves sometime after that at the current usage rate. Other energy sources may be developed, but at this time the outlook for

such is bleak which means that industrial projections may be too optimistic even through the 1985 time period.

(3) Economy. A third factor that must be considered is the world economy. Currently many countries are on the border of bankruptcy largely due to the price of petroleum. Many economists believe that any additional petroleum price increases whatever would completely destroy the economies of many countries, including some that currently are markets for US industry. Such an eventuality would mean a drastic reduction in US exports, particularly in aerospace, electronics, and instrument product categories. The result would be a closure of many of the producing units, consequent unemployment, and even deeper recession than occurred in 1974-1975. Certainly any petroleum price increase will set off a new round of inflation even in the US, which will reduce the domestic market (as well as foreign ones) and have a like effect on employment that could be iterative in impact. Even now some major US corporations are making corporate plans based on expected double-digit inflation and double-digit unemployment in the US as early as 1978. If this occurs, then all industrial projections made in this appendix are of little value.

c. Capacity. In light of the possibilities cited above, it would appear that the projections cited earlier may be overly optimistic. At the same time the spectre of a complete collapse of the industrial sectors discussed in this appendix probably is overly pessimistic. There probably will continue to be some growth in all industrial sectors, but at rates somewhat lower than those projected. In any event, it appears that plant capacity and industry sector capability will remain adequate through the midterm to meet peacetime military requirements with proper prior planning.

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ANNEX C

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ANNEX C

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