APPENDIX C

COMBAT SYSTEMS ELEMENTS CONSIDERED

SUMMARY

A summary of Combat System elements considered for the CPCX design is contained in the following appendix. The design teams researched guns, ASW sonars, air /surface search sensors, missiles, mine hunting devices, and small boats from various countries. This provided a database of current weapon systems and their capabilities from which the design teams could pick the elements needed to satisfy given requirements and meet projected threats.

GUNS

LARGE

Name	Weight	Rate	Ranges (surface/AA)	Source
5"-54 MK 45	24.27 t	16-20 rds/min	12.4 nm / 15 km	US
Oto Melara 127 (Alleggeritto)	20.5 t	45 rds/min	8.6 nm / 13.6 km	Italy
Vickers 4.5"	23.25 t	25 rds/min	11.9 nm	UK
Bofors TAK 120	28.8 t	80 rds/min	10 nm	Sweden

MEDIUM

Name	Weight	Rate	Ranges (surface/AA)	Source
Greusat-Loire 100	13.5 t	10,40, 90 rds/min	9.15 nm / 6 km	France
Oto Melara 76	7.5 t	80 rds/min	16 km	Italy
Bofors TAK 76	6.5 t	30 rds/min	6.8 nm	Sweden
Bofors 40	5.6 t	600 rds/min	6 km / .4 km	Sweden
Breda Fast 40	6 t	900 rds/min	6.75 nm / 8.7 km	Italy
Trinity 40	4000 kg	330 rds/min	1.61 nm / 6 km	Sweden

SMALL

Name	Weight	Rate	Ranges (surface/AA)	Source
Mk 88 Bushmaster 25	589 kg	180 rds/min	1.33 nm	US
Giat 20	222 kg	650 rds/min	1 nm	France
Oerlikon 20	500 kg	800 rds/min	1 nm	Int'l

ANTI-SHIP MISSILE DEFENSE

Name	Weight	Rate	Range	Source
Midas 27	4.6 t	7200 rds/min		Germany
Myriad 25	7700 kg	10,000 rds/min	1.07 nm	Italy
Sea Zenith 25	5450 kg	3400 rds/min	1.07 nm	Switz
Goalkeeper 30	6800 kg	4200 rds/min	1.61 nm	Neth
CIWS 20	6.18 t	4500 rds/min	.75 nm	US

NEW TECHNOLOGIES

ETC: Liquid propellant, Large mounts only
Rocket Assisted Projectiles
Guided Munitions: Command Guidance, IR seeker, laser designator, Semi-active

ASW SONARS

HULL MOUNTED

Name	Frequency	Weight	Source
AN-SQS 505	5.4 KHz		Canada
Type 5051 (505 improved)	5.4 or 7 KHz		Canada
Diodon	12 KHz	1500 kg	France
PHS-32	3 freqs	2500-8000 kg	Neth
Sea Hunter	10.5 KHz		UK
Sea Searcher	6 to 9 KHz		UK
AN-SQS 56	5.4 KHz		US
AN-SQS 53	3.5 KHz	60000 lb dome	US

TOWED ARRAY OR VDS

Name	Frequency	Weight	Source
SONAC PTA			Fin
Diodon	12 KHz	8 tonnes	France
Salmon	19 KHz	7630 kg	France
ATAS		4.7 tonnes (mod)	UK
COMTASS			UK
AN-SQS 35	13 KHz		US
AN-SQR 19			US

DIPPING SONARS

AN-AQS 13	9.25-10.75 KHz	775 lb	US
AN-AQS 18	9.25-10.75 KHz	600 lb	US
ALFS			

NEW DEVELOPMENTS

Twin Tails
Bi-static towed arrays
Combined fish and array

Radar Characteristics

COUNTRY	DESIG.	Peak Pwr (KW)	Avg. Pwr. (KW)	Freq	Pulse length (microsec)	Gain (dB)	BW horiz (deg)	BW vert (deg)
Israel	EL/M-2207	425	425	3.1-3.3 GHz	0.4-1.4	28	3.3	10
US	SPS-49	360	13	850-942 MHz	125	29	3.3	9
US	SPS-65/ER	25	1.2	1.2-1.35 GHz	7	23	3	
US	FAST	1000	10	5.4-5.9 GHz	0.6-200	-	3	9
France	CASTOR II	30	0.12	6.2-10.4 GHz	7.5	43	0.67	1.5
Netherland	SMART	150	-		0.6	31.5	2	7
-	XPAR	5000	58	10 GHz	5.5	40	1.5	1.5
US	SPY-1D	5000	58	3.1-3.5 GHz	var	42	1.7	1.7

ANTI-SURFACE MISSLES

NAME	DESIGNATOR	COUNTRY of Origin	LAUNCH Vehicle	WEIGHT (lbs)	RANGE (Km)	SPEED (Mach)	CRUISE ALT (feet)	ATTACK ALT (feet)	WARHEAD WGT (lbs)	WARHEAD TYPE	GUIDANCE	DIAMETER (ft)	LENGTH (ft)	COST (Dollars)	COMMENTS
Silkworm		China	ship/shore	2998	95	0.9		30-50	513	blast	MPR,IR,	0.76	7.36		
Flying Dragon	FL-1/SY-1		ship/shore					30	513		MPR				
Sea Eagle															
	FL-2		ship/shore	1300	60	0.9		skimmer	365	SC	"Anti-Jam"	0.54	6		
	FL-7		ship/shore	1800	32	1.4	60-100			SC	ECCM features	0.54	6.6		
	C301/802		ship/air	815	80-50	0.9	20-30	5-7	165	SAP	MPR	0.36	5.8		
Exocet		France	ship/air/sub	750	42-65	0.93	9	2.5-8	165	Blast/frag	see note 1	0.348	5.2	$400,000	
ANS			ship/air	850	180	2	high alt	skim/weave	180	SAP		0.35	5.7	$1,500,000	
	SS 11		ship/air/	66	3.3	580 fps	LOS	LOS	16	3.5 # HE blast	Wire Guided	6.4 in	47.6 in	$1,900	obsolete
	SS12M		ship/air/shore	165	6.5	580 fps	LOS	LOS	62.5 #	SAP,several	WG	7.1 in	73.7 in		
Gabriel	II	Israel	ship/air/shore	500	40	0.65		2.5	180		optical/CG	0.35	3.35	$400,000	
	III			560	36	0.65		1.5	150		FAAS	0.34	3.85	$450,000	
	IV			960	200	0.85			200			0.43	4.7	$675,000	
Otomat	I	Italy	ship/	770	60	0.9	80	175 pop	210	blast	Xbnd AS			$400,000	83 known launch platforms
	II				180	0.9		skim			CG helo/				
Otomach					193-380	2			100		AS/IR/TV				
Sea Killer				330	26	1.9	5	3.4	70	HE frag	beam rider	0.32	4.84		
SeaPower	SSM-1	Japan	ship/air	661	150	0.9			225			0.35	5	$680,000	Harpoon Copy Cat
Penguin	AGM-119	Norway	Ship/shore	330	40	0.8	100	skim	250 #	SAP	IR	0.28	2.95	$220,000-$550,000	
Perguin II	Rb 08A	Sweden	ship/shore	782	75	0.65			250	blast frag		0.65	5.7		
	Rb 12														
	RBS 15		ship/air	598	70	0.7			250	SAP	X,Ku	0.5	4.35	$479,000	
Styx	SS-N-2	Russia	Ship/Shore	2300	25	0.9	400	100	500		I band active	0.76	6.5		
Sandbox	SS-N-12		ship/	5000	300nm	2.5			1000	HE		0.9	11.7		
Sunburn	SS-N-22		ship/		68nm	2.5			454	HE			9.15		
Hellfire	AGM-114A	USA	ship/air/shore	50	3nm	1 +			9.1	SC	SAL	18	1.63		
Tomahawk	TLAM/TASM		Ship/air/sub	2640	250-700	0.75	15-100m	30m	454 kg	various	Inertial/Tercom	1.8	18.06	$1,800,000	
Harpoon	AGM-84		ship/air	520	80nm	0.85			225	var	var	34.3	4.63	$300,000	40% of production for foreign sales

Notes	
MPR	Mono Pulse Radar
CCP	Course Correcting Projectile
SAP	Semi Armor Piercing
FAAS	Frequency Agile Active Seeker
AP	Armor Piercing
SC	shaped Charge
SAL	Semi-Active Laser

ANTI-AIR MISSLES

NAME	COUNTRY of Origin	LAUNCHER	WEIGHT (lbs)	RANGE (Km)	SPEED (Mach)	GUIDANCE	DIAMETER (ft)	LENGTH (ft)	Comments
MASCURA	France	twin	4600	30	3	Semi-Active	1.3	28.2	Need 3D radar reloading semi-auto
MISTRAL		launch tube	44	3.7	2.6	Active	0.3	5.9	
CROTALE		VLS R&D	231	8	2.5	Semi-Active IR TV	0.5	9.8	designed to counter air saturation attacks
RAM	USA	bolt on several	1621	5.6	1.0 +	Passive RF/IR	0.42	9.2	
STINGER		Shoulder	22.3	3	2.2	Optical IR Homing Passive IR/UV	0.23	5	
SM-2 ER		VLS/Rail	2998	30 +	2.5	Semi-Active	1.13	26.2	
SM-2 MR		VLS/Rail	1386	10 +	2.5	Semi-Active	1.13	14.7	
SEA SPARROW		VLS R&D/Box	500	12	1	Semi-Active CW RF	0.67	12	
SEA DART	Great Britain	cannister	1210	50	3	Semi-Active	1.4	14.5	
SEA WOLF		vertical	1761	4	2	Semi-Active	0.6	8.5	launch and control automatic
ASPIDE	Italy	box	485	11	2.5	Semi-Active	0.7	12.1	good in ECM and clutter
GRAIL	Russia	shoulder	201	6	1.5	Active IR	0.2	4.8	

ANTI-SUB MISSLES

NAME	COUNTRY of Origin	LAUNCHER	WEIGHT (lbs)	RANGE (Km)	SPEED (Mach)	GUIDANCE	DIAMETER (ft)	LENGTH (ft)	Comments
ASROC	USA	MK13,26,10,VL	957	7		Active	1.1	15.1	Anti-Sub
IKARA	Australia	Rail/tubes	1400	13	0.8	Active	1	11.2	Anti-Sub

Mine Hunting Devices

Hull Mounted	Manufacturer	Frequencies	Weight	Power Required	Max/Min Depths	Beamwidths	Cost	Notes/Comments
SH100	Simrad	95/335kHz			up to 100 m	Search: 45° hor, 1.6° ver Classification: 16° hor, .25° ver		Retractable, detects 600 m, classify 200 m, can operate search and classification sonars simultaneously, 10° vertical coverage in both modes
Variable Depth/ Towed/Side Scan/ROV								
RMOP-Dolphin	ISE (UK) / NSWC	7.3 m long 1 m diameter	2832 kg	150 shp	semi-submersible			air breathing, diesel powered semi-submersible, connect to ship via LOS UHF data link. 24 hr endurance at 12 kts. Operable in Sea State 5.
SEABAT6012	Reson Systems	455kHz	100 lbs	N/A	N/A	Search: 165° hor, 15° ver Classification: 1.5° hor, 15° ver		Volume search and near surface surveillance sonar mounted on keel of Dolphin. Up to 200 m range. Multiple beams (60), with 20 kHz bandwidth. Operates at speeds up to 12 kts.
AN/AQS-14	Westinghouse							towed array behind RMOP. Used for bottom scanning. 3 m long
SQQ-14/30	Martin Marietta	80/350 kHz			45 m	Search: 100° hor, 10° ver Classification: 18° hor, 10° ver		
PVDS: Sutec Double Eagle/TSM 2022 Mk3	Bofors/ Thomson Sintra	165/400 kHz	480 kg (including payload		300m	Search: 63° hor, 19° ver Classification: 12° hor, 7° ver		5 kts, 600 m umbilical

Small Boat Requirement

Type	Length	Beam	Max speed	Cargo/Passengers	Max Weight	Range	Engine	Notes
Surf boat	26 ft	8 ft	16 kts light, 12 loaded	3500 lbs or 16 passengers	5000 lbs light	50 nm @ 10 kts	Diesel	Self righting, self bailing
Fast boat	21-24 ft	8.5 ft	30 kts	1800 lbs or 8 passengers	4000 lbs light	25 nm @ max speed, 50 nm @ 10 kts	Diesel	Self bailing, 12" fender minimum (5 kt bumper), stern launchable