

PART III  
EOPT CAPABILITIES

STAFF COLLEGE  
SOs' HANDBOOK 1967

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PART III - ECPT CAPABILITIES

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MAX RANGES OF AFV WPNS IN METRES

Serial (a)	AFV (b)	Wpn (c)	HE (d)	Anti-tk (e)	MG (f)	Notes (g)
1.	Centurion 105-mm	105-mm	7,200	1,800	-	With ranging MG
		.50-in coaxial MG	-	-	1,600	Normally limited to 800 when the tracer burns out.
		.30-in comd's MG	-	-	800	
2.	Chiefly	120-mm	7,500	3,000 (see note)	-	Assumes optimum battlefield range for anti-tk 1,800. This is max range of ranging MG; above this range a hit will kill but accuracy deteriorates.
		7.62-mm coaxial MG	-	-	1,600	} Normally limited to 1,000 when the tracer burns out.
		7.62-mm comd's MG	-	-	1,600	
		.50 ranging MG	-	-	1,800	
3.	Saladin	78-mm	5,400	1,600	-	
		.30-in coaxial MG	-	-	800	
4.	Saracen	.30-in MG	-	-	800	
5.	Ferret Mk I	.30-in MG	-	-	460	Reduced range of .30 MG is due to lack of proper mounting.
6.	Ferret Mk II	.30-in MG	-	-	800	Proportion fitted with Vigilant (anti-tk CW with range of 1,375 m).
7.	Hornet	Malkara	-	450 (min) 4,000 (max)	-	
8.	FV 432	Swingfire	-	Classified see note	-	For Staff College purposes assume same as Malkara, ie 450 (min) and 4,000 (max).

# PARTICULARS OF GUNS AND HOWES

Serial (a)	Eqpt (b)	Max Range (metres) (c)	Type (d)	Ammo		Rates of Fire (RPM)					Remarks
				Weight lbs (e)	1st time RPM (f)	Intense (g)	Rapid (h)	Normal (i)	Slow (j)	Very Slow (k)	
1.	105-mm pack	10,000	*HE Smoke HESH Tgt Indicating Illuminating Gasifier	33	150 18 12 16 16 4	5	4	3	2	1	Gun can be broken down into 12 loads - heaviest 2½ cwt. Ammo seals not applicable to cdo it regt.
2.	105-mm SP (Abbot)	17,500	*HE Smoke HESH Tgt Indicating Illuminating	35	188 20 18 12 12	6	5	3	2	1	Ammo carried on gun: HE - 32 HESH - 6 Swimming preparations take 1.5 mins. Speed in water 2.4 kts.
3.	5.5-in	16,500	*HE	80	134	2	1½	1	½	½	
4.	155-mm SP (M109)	14,800	HE	95	134	3	2	2	½	½	Rates of fire provisional.
5.	8-in how	16,500	*HE	200	56	1½	1	½	½	1/6	
6.	175-mm SP (M107)	32,800	HE	147	142	1	-	½	-	-	Rate of fire provisional.

For planning purposes it is normal to take 90% of the max range.

\* Incl airburst.

## FRONTAGES AND SAFE DISTANCES

(all in metres)

Eqpt (a)	Max Eff Frontage of One HE Shell (b)	Reasonable Safe Distance for HE from Nearest TPS	
		Observed Fire (c)	Predicted Fire (d)
105-mm pack and SP	40	250	500
5.5-in gun	50	400	500
155-mm SP (M109)	55	400	500
8-in how	65	700	800
175-mm SP (M107)	60	600	700

Above figures can be halved for tps in APCs.

# NUCLEAR ARTY

Serial (a)	Nature (b)	Eqpt (c)	Warhead Yield (d)	Types of Burst (e)	Range (ft) Min Max (f) (g)		Rate of Fire by Bty (h)
1.	Gun	8-in how	1 and 2 KT	High and low airbursts	2	20	4 per hr (max) 12 per day (sustained)
2.	FPR	Honest John	5, 20 and 50 KT	High and low air surface bursts	7	40	8 per day

These figures are for trg only and are based on the data for a Medium Range Cannon and a Large Free Rocket given in Artillery Training Volume VIII Pamphlet 2 (Nuclear Artillery, Tables of Effects).

# AD ARTY

Serial (a)	Nature (b)	Eqpt (c)	Max Eff Height (d)	Weight (lbs) (e)	Ammo Type (f)	1st line (trg) (g)	Remarks (h)
1.	LIAD	40-mm L70 (towed) with FCE AA No 7	7,000 ft	2	HE	603	Can fire at the rate of 240 rpm. Blindfire capability.
2.	LIAD	ET 316	Adequate overlap with Thunderbird 2	88	HE	13	Performance details classified. In practice terrain will always limit performance. For planning purposes, assume each weapon covers 120° (2130 mils) out to 4,000 m.
3.	Hy AD	Thunderbird 2	60,000 ft *	5,000 (total msl weight)	HE	4	Propellant. Solid fuel. Guidance. Semi-active using target illuminating radar. * Trg figure only.

# RADAR USED BY AB ARTY

Serial (a)	Type of Set (b)	How Carried (c)	Used By (d)	Used For (e)	Displayed Range (f)	Remarks (g)
1.	Radar AA No 4 Mk 7/1 and Radar AA No 4 Mk 7/3	Self-contained tlr towed by a 10-ton tractor.	LLAD	Local wng	35 km 70 km 105 km	Normally used on a displayed range of 35 km. Mk 3 is fitted with MFI.
2.	Radar AA No 7 Mk 4	Mtd on same chassis as 40/70 gun and towed by 10-ton tractor.	LLAD	Tgt acquisition and tracking	16 km	Commonly known as FCE7. Used with 40/70 gun.
3.	Radar AD No 10 Mk 1	Self-contained tlr towed by 10-ton truck. Aerial removed and carried on towing veh during transit.	Thunderbird 2	Tgt illumination	Classified	Can also travel with aerails in semi-retracted position.
4.	Radar AD No 11 Mk 1	Two self-contained tirs towed by 10-ton tractors.	Thunderbird 2	Tac con	Classified	Both radars used together with a tly CP 2 x 5-con tirs) for tac con.
5.	Radar AD No 12 Mk 1	Self-contained tlr towed by 10-ton tractor.	Thunderbird 2	Height finding	Classified	

LOC RPTs

LOC RPTs

Serial (a)	Type of Eqpt (b)	How Carried (c)	Used By (d)	Used For (e)	Capability (f)	Remarks (g)
1.	S rg eqpt	PV 432 or truck 3-ton, 4-ton	S rg tps of loc regt. Loc bty of strat res.	Loc guns. Secondary roles: a. Loc of mortars. b. Adjustment of fire.	Fix within 100 m up to 11 x base length or within 200 m up to 5 x base length. Up to 5 x base length 10,000-12,000 m. Computer can store info on 60 tgts. Accuracy affected by high winds. Swamped by intense activity.	One per S rg tp. Approx 3 hrs to deploy. Response time - 5 mins.
2.	USD 501 Drone	Truck 3-ton	Surv bty of loc regt. Loc bty in strat res.	Confirming tgts. Tgt acquisition. Gen surveillance. Post strike analysis.	Total range - 90 km. Fit paths pre-planned with up to 3 turns. Cameras can be op twice per sortie. Total area photographed per sortie: Dayit - 1.5 km x 45 km N1 - 1.5 km x 5 km Tp capable of 3 mins per 2 hrs. Response time - approx 50 mins from receipt of msg to delivery of negatives.	Performance classified. Data in colm (f) for trg purposes only. Sixteen drones per tp.  However the sustained rate of a tp would be approx 20 mins per day.
3.	Radar No 8 Mk 1 (Green Archer)	1-ton arm'd or Saracen	Loc tps of fd regts. Loc bty strat res. Loc tp PABELP.	Loc mortars. Adjustment of artillery and mortar fire.	Fix well within 100 m under optimum sitting conditions. Max range 10,000 m for 81-mm mortars. Longer for med and heavy (70 mm) arc. Scanned 400° (71 miles) arc. By rain can halve range.	Two per sect. Works independently. Time into action - 6 mins given survey. Locating time - approx 15 secs. Silent generator.

INF WPNS

Serial	Wpn	Cal	Svc Rates of Fire			Max Eff Range	Remarks
			Rapid	Normal	Slow		
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)
1.	<u>SL Rifle</u> <u>101</u>	7.62- mm	20 rpm	5 rpm	-	Sighted to 800 m, but rarely used in action over 300-350 m.	Self loading. Mag capacity 20 rounds. Weight 9 lbs 6 ozs. Carried by all oftrs (less those at bn HQ), sect comds and all rfn.
2.	<u>SMG</u> <u>12A3</u>	9-mm	Bursts of 2-3 rounds or single shots			200 m	Mag capacity - 34 rounds. Carried by oftrs at bn HQ, most sigs, sp wpns and admin pers, dvrs and att pers; total in the bn 233.
3.	<u>Pistol</u>	9-mm	6 rounds in 5 seconds			20-25 m	Mag capacity - 13 rounds. Weight 2 lbs 5 ozs with full mag. Held as a pool in each bn for special requirements.
4.	<u>GPMG</u> <u>(LT</u> <u>Role)</u>	7.62- mm	100 rpm	25 rpm	-	800 m	53 in a bn. 10 in a rifle cwy. 3 in a rifle pl. Belts of 50 rounds. 950 rounds carried in a rifle sect.
	<u>GPMG</u> <u>(SF</u> <u>Role)</u>	7.62- mm	200 rpm	100 rpm	-	1,800 m (1,100 m by day - burn out range of tracer)	The lt role GPMG is given a sustained fire capability by use of a conversion kit containing 2 barrels, dial sight and tripod. 3 conversion kits per rifle cwy.
5.	<u>2-in</u> <u>Mortar</u>	-	3-4 rpm	-	-	450 m	One in each rifle pl. 18 bombs (smoke and illuminating) normally carried.
6.	<u>81-mm</u> <u>Mortar</u>	-	12 rpm	8 rpm	4 rpm	5,000 m	Weight 88 lbs. HE (some with VT fuse), smoke, coloured smoke and para illuminating bombs carried.
7.	<u>Grenade</u> <u>36</u>	-				25-35 m	Thrown by hand. Thrower must be behind cover.
8.	<u>Grenade</u> <u>80</u> <u>(Smoke)</u>	-				Can be thrown 25-35 m.	White phosphorus.
9.	<u>Grenade</u> <u>83</u> <u>(Coloured</u> <u>Smoke)</u>	-					Supplied in red, yellow, green and blue.
10.	<u>Grenade -</u> <u>Energy</u>	75-mm				75 m	Not issued to APC bn. Inf bn scale is 8 launchers per rifle pl and 10 spars.
11.	<u>Carl</u> <u>Gustav</u> <u>84-mm</u> <u>Recoil-</u> <u>less Gun</u>	-				400 m (HEAT) moving tgts 500 m (HEAT) static tgts 1,800 m (illuminat- ing)	Penetrates 10-in armour. In APC bn scale is 4 per rifle pl and recce pl, 2 per sp pl plus 5 total for bn HQ and HQ Coy. Inf bns 1 per rifle and admin pl, 4 for recce pl plus 3 total for bn HQ and HQ Coy.
12.	<u>Wombat</u> Each gun has an .551 MG as the subcal ranging device.	120- mm	Max rate of fire about 4 aimed rpm			Normal battle range 1,000 m against moving tgts; 1,200 m against stationary tgts.	Back blast is consi- derable, a cone shaped danger area extending from behind the gun at about 40° and for a distance of about 100 yds. Provided tps are dug in, the danger over 20 yds is not great.
13.	<u>Vigilant</u>	-	15-20 seconds between shots			1,500 m (2/5 m min)	Wire con. Will penetrate armour of all known tks if angle of impact is good.



## SCALE AND CAPABILITIES OF NI FIGHTING AIDS

1. For reasons of security, it is not permitted in every case to give actual scales of issue and performance figures. In Staff College exercises the assumptions listed below are to be made for eqpts in British svc. En eqpts will be assumed to have comparable performance unless stated to the contrary. Ranges are quoted for best conditions.

### Infra-red

#### 2. Inf Bn Infra-red.

##### a. Wpn Sight.

(1) Range. 300 m (increased to 600 m with Tk Infra-red Searchlt illuminating).

(2) Rifle Coy Scale.

Coy HQ	1
Each sect	1
Mortar/Carl Gustav	1
Wombats	2
Total	13

##### b. Common User Binoculars and Veh Headlt Filters.

(1) Range. 80 m.

(2) En Scale. F ech vehs.

##### c. Head Mtd Wpn Device.

(1) Range. 600 m.

(2) Rifle Coy Scale. 15.

(3) Recco Fl Scale. 9.

#### 3. Armd Regt Infra-red.

##### a. Wpn Sight.

(1) Range Using Own Source. 800 m.

(2) Range Using Flank Source. 1,200 m.

##### b. Driving Aid. Range 80 m.

##### c. AFV Wpn Device. Range 1,000 m.

##### d. Scale.

(1) Chieftain 100%.

(2) Centurion 100%.

(3) Recco Tp 100% driving aids.

(4) F and A1 Echls 100% driving aids.

#### 4. Armd Car Regt. F and A1 echelons 100% driving aids.

#### 5. Engr.

##### a. Hand Torches.

(1) Range. 10 m.

(2) Scale. Special issue.

##### b. Driving Aid.

(1) Range. 80 m.

(2) Scale. F ech vehs.

### Radar

#### 6. Ftl Radar.

##### a. Performance.

(1) Range Vehs. 2,000 m.

(2) Range Men. 700 m.

(3) Can only detect moving tgts.

(4) Manpack.

##### b. Power. Bty.

##### c. Scale. Three sets per coy.

7. All Arms Radar.

a. Performance.

- (1) Range - Vehs. 5,000 m.
- (2) Range - Men. 2,500 m.
- (3) Can only detect moving tgts.
- (4) Two-man load.

b. Power. Bty.

c. Scale.

- (1) Bn Recce Pl 4
- (2) Armd Regt Recce Tp 4
- (3) Arty OPs 1 each

8. Anti-radar Devices. These devices are still only under development.

White Lt

9. Wpn Sight with Tk Searchlt.

- a. Range Using Own Source. 1,000 m.
- b. Range Using Flank Source. 1,500 m.
- c. Scale. All tks.

10. 105-mm SP - Para Flare.

- a. Range. 12,500 m approx.
- b. Burning Time. 20 seconds.
- c. First Line. 12 rpg.

11. 81-mm Para Flare.

- a. Range. 5,000 m.
- b. Burning Time. 40 seconds.
- c. First Line. 4 rpg.

12. Carl Gustav Para Flare.

- a. Range. 1,800 m.
- b. Burning Time. 28 seconds.
- c. Scale with Wpn. 4 rpg.

13. Hand-held Flare.

- a. Range. 300 m.
- b. Burning Time. 25 seconds.
- c. Scale. Special for op.

Navigation Aids

14. Performance.

- a. Accuracy. 2% of distance moved since resetting.
- b. Info. Grid ref and heading.
- c. Scale.

(1) Inf Bn.

- (a) Bn HQ 2
- (b) Coy Comd's Veh 1 each
- (c) Recce Pl 5
- (d) Mortar Sects 1 each
- Total 14

(2) Armd Regt.

- (a) Sqn HQ 2
- (b) Bch Tp 1
- (c) Recce Tp 1 per scout car

## AFV CHARACTERISTICS

Serial (a)	Veh (b)	Armt (c)	Weight (d)	Height (e)	Length (f)	Width (g)	Petroleum (h)	Range (i)	Ammo (j)
1.	Centurion 105 mm	1 x 105-mm coaxial MG 1 x 30-in coaxial MG 1 x comd's .30-in MG	51 tons	9' 7"	32' 4"	11' 1"	228 gals (MT 80)	150 miles (rds) 85 miles (mixed mov)	70 rounds x 105-mm 14 belts @ 250 rounds .30-in MG
2.	Chieftain	1 x 120-mm 1 x 7.62-mm coaxial MG 1 x 7.62-mm comd's MG 1 x .50-mm ranging MG	51 tons	9'	32' 3"	11' 8"	210 gals (any fuel but DIESO is best)	250 miles (rds) 160 miles (mixed mov)	53 rounds x 120-mm 30 belts x MG
3.	Saladin (armd car)	1 x 76-mm 1 x 30-in coaxial MG 1 x comd's .30-in MG	13 tons	7' 5"	16'	8' 3"	53 gals (MT 74)	240 miles (rds) 200 miles (mixed mov)	42 rounds x 76-mm
4.	Saracen (wheeled APC)	1 x .30-in MG	10 tons	8'	16' 4"	8' 3"	44 gals (MT 74)	220 miles (rds) 170 miles (mixed mov)	-
5.	FV 432 (tracked APC) FV 432 (tracked CW launcher)	1 x 30-in MG (in armd regts) 1 x 40mm (in inf bns) Swingfire	13 tons	8' 5"	17' 6"	8' 9"	80 gals (MT 80)	290 miles (rds) 150 miles (mixed mov)	-
6.	Ferret Mk I (scout car liaison)	1 x .30-in MG	4 tons	4' 8"	12' 7"	6' 3"	21 gals (MT 74)	200 miles (rds) 120 miles (mixed mov)	14 msls on vehls
7.	Ferret Mk II (scout car recce)	1 x .30-in MG	4 tons	6' 2"	12' 7"	6' 3"	21 gals (MT 74)	As Mk I	-
8.	Hornet (modified 1-ton armd)	Malkara	5 1/2 tons	7'	16' 2"	6' 9"	32 gals (MT 74)	250 miles	4 msls on veh

B VEH CHARACTERISTICS

Veh Type	Make	Unladen Weight (lbs)	Laden Weight (lbs)	Dimensions					Average Max Speeds (mph)	Approx Range of Action	Remarks		
				Height	Length	Width	Track	Wheel Base					
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	
MC 500 GC	Triumph	370	-	3' 5"	8' 8"	2' 4"	-	4' 7"	55	20	70	200	(3)
TIR. CARGO. 1-TON	Sankey	830	1,950	3' 3"	9' 6"	4' 6"	4'	-	-	-	-	-	-
TIR. CARGO. 1-TON	Sankey	1,520	3,760	5' 4"	11' 8"	6' 7"	5' 8"	-	-	-	-	-	-
CAR UTILITY. 1-TON	Rover Mk 9	3,696	5,826	6' 7"	14' 10"	5' 4"	4' 2"	9' 1"	45	15	16	200	Can be FFW
TRUCK GS. 1-TON. 4 X 4	Rover Mk 8	4,765	6' 4"	12' 5"	5' 7"	4' 2"	7' 4"	45	15	16	220	Can be FFW	
TRUCK GS. 1-TON. 4 X 4	Austin	3,668	4,480	6' 2"	12'	5' 5"	4' 1"	7'	50	20	12	300	Can be FFW
TRUCK GS. 1-TON	Austin K9	6,300	10,192	8' 8"	17' 2"	7' 3"	5' 11"	11' 5"	45	12	12	300	Can be FFW
TRUCK GS. 1-TON	Morris MRA 1	7,140	10,000	8' 9"	17' 8"	6' 10"	5' 1"	10' 3"	45	12	10	250	Can be FFW
TRUCK 1-TON ARMED	Humber	9,260	12,432	7'	16' 1"	6' 9"	5' 8"	9'	40	20	8	250	Can be FFW
TRUCK AMB 3-TON	Ford E3	10,864	12,318	10' 2"	20' 10"	8'	6'	12' 6"	40	12	8	280	4 stretchers
TRUCK CARGO. 3-TON	Bedford RL	9,838	18,838	9' 10"	20' 11"	7' 10"	6' 1"	13'	40	12	8	250	Carries 20 men in TOV role
TRUCK, HIGH MOBILITY ROAD CARR. 5-TON	Alvis (Stalwart)	18,613	29,813	8' 1"	20' 7"	8' 4"	6' 9"	-	41	35	2.5	250	
TRUCK CARGO. 10-TON	AEC	21,952	44,353	11' 9"	23' 10"	8'	6' 6"	12' 10"	30	10	6	300	Drive 6 x 4 DIESEL
TRUCK CARGO. 10-TON	Leyland	30,184	53,760	12'	30' 10"	8' 6"	8' 10"	17' 9"	30	12	2.5	300	Drive 6 x 6
TRACTOR REC MED	Scammell	26,180	10' 4"	20' 7"	8' 6"	7' 1"	11' 6"	30	12	2.5	300	16-ton winch	
TRACTOR GS. 7X 7 1/2. WITH TIR	Thornycroft ANTAR	85,000	220,000	14' 6"	62'	13' 1"	7' 6"	-	25	5	1	200	

Note: Height measurements incl normal canopy and superstructure.

C VEH CHARACTERISTICS

Ser. No.	Vehicle Make	Approx Un-laden Weight (lbs)	Dimensions			Average Speed (mph)	Air-droppable	Remarks
			Height	Length	Width	Road		
1.	Wheel tractor	13,800	10' 2" overall cab 8' 6" without shovel	24' 10" with Back Acter and shovel	7' 1" (E)	15-20	Yes	Tows 2-ton 4 wheeled tlr carrying alternative front and back end eqpts. Ditto.
2.	Med wheeled tractor	17,341	10' 2" overall cab 8' 6" without shovel	18' 5" with shovel	7' 3" with shovel	15-20	Yes	
3.	Med wheeled tractor	33,820	10' 8" with spot light 9' 2" without shovel 12' 5" with shovel	19' 8" 12' 7" with shovel	9' 6" 9' 0" with shovel	20-25 20-25	No No	Spare eqpt carried on 2-ton 4 wheeled tlr. Ditto.
4.	Grader	19,300	12' 8" 11' 0" 8' 9"	15' 0"	10' 3"	Carried 5.5 mph on 5' 9" speed winch. 5.85 Top Speed on 12' 15"	Yes Yes	Pitted with blade and winch. Ditto.
5.	Grader	40,393	12' 8" 11' 0" 8' 9"	18' 3"	12' 0"	Carried 5.5 mph on 5' 9" speed winch. 5.85 Top Speed on 12' 15"	Yes Yes	Pitted with blade and winch. Ditto.
6.	Excavator truck mounted	48,944	12' 8" 11' 0" 8' 9"	23' 10" overall chassis length 31' 0" approx overall length for travel	8' 0"	12 5-10	No	
7.	Grader	15,550	7' 6" without cab 9' 8" with cab	22' 0"	8' 0"	15	Yes	
8.	Grader	27,347	10' 1" with cab 7' 10" without cab	25' 5"	8' 3"	15	No	
9.	Scraper	16,000	9' 5"	28' 0"	9' 8"	15 towed	No	
10.	Grader	53,538	13' 7"	38' 9" with jib 24' 6" without jib	8' 2"	5	No	
11.	Purification	5,500	8' 4"	15' 0"	6' 5"	10 towed	Yes	
12.	Water	2,590	4' 3"	9' 6"	4' 8"	10 towed	Yes	

# SEA LIFT CAPABILITY

## SEA LIFT CAPABILITY

Serial	Ship	Range and Speed	Helicopters/ Landing Craft	Crane Lift	Typical Troop Lift	Typical Vehicle Lift	Bulk Fuel	Bulk Water
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)
1.	Commando Ship (LPH) LIFTON BULMARK	a. 3,000 at 27 kts b. 6,000 at 20 kts	4 LCVP 18 Wessex Helicopters	6 x 11 tons	a. Commando Group 900 - more than 3 weeks b. 1,200 - less than 3 weeks c. 1,550 if no helicopters	55 x 3 ton equivalents	a. AVCAS/MOCAS 200 tons b. AVCAT 1,000 tons c. Dieso 300 tons	435 tons
2.	Assault Ship (LPH) FEARLESS INTREPID	6,000 at 20 kts	4 LCMC 4 LCVP 4 Wessex in ship to shore assault max strength 8 Wessex 13 Sioux/ SCOUT	1 x 15 tons 1 x 6 tons	a. 340 for long periods b. 600 for periods up to 7 days	a. 20 main Battle Tanks 43 x 3 ton equivalent 50 tons stores or b. 1,600 tons	a. AVCAS/MOCAS 40 tons b. AVCAT 30 tons c. Dieso 128 tons	320 tons
3.	LSL SIR LANCELOT etc	a. 6,000 at 17 kts b. 7,800 at 15 kts	Either 6 LCVP or 4 Pontoon Regts 240 ft of Pontoon causeway	2 x 20 ton 2 x 3 ton	a. 340 for long periods b. 600 for periods up to expense of vehicles	a. 16 Tanks 66 x 3 ton equivalent 150 tons stores or b. 1,300 tons	a. AVCAS/MOCAS 110 tons b. AVCAT 50 tons c. Dieso 50 tons	300 tons
4.	Heavy Lifts Ship	10,000 at 15 kts		50 tons	150 men	a. 10,000 tons stores or b. 100 Tanks 200 tons stores or c. 40 Tanks 16 x 3 ton equivalent 200 tons stores		

Note: The above figures are to be used in preference to those in JSP IV.

## ARMY AC

Ac	Passengers	Speed (kts)	Max Operating Height (ft)	Landing Strip (yds)	Fuel	Range (nm)	Endurance (hrs)	Utilisation Rate (hrs/month)	Remarks
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
Alouette	4	80	6,000	Circle radius 25	AVTAG or AVTUR	200	2½	40	Two stretcher cases and one sitting cas can be carried.
PH Beaver	5	110	8,000	300-350 x 25	100/130 AVGAS	550	5½	45	Two stretcher cases and two sitting cas can be carried.
Scout AHI	4	100	7,000	Circle radius 25	AVTUR or AVTAG	250	2½	35	Three stretcher cases and one sitting cas can be carried.
Skeeter 12	1	75	3,500	Circle radius 25	100/130 AVGAS	130	1½	30	Will not op in tropical climates.
Sioux AHI	2	70	7,000	Circle radius 25	100/130 AVGAS	250	4	40	Two stretcher cases can be carried.

## Notes:

- Colm (d) refers to the max height above mean sea level of the strip or LG from which the ac can op.
- Colm (i) utilisation rate allows for ac unserviceability. Thus, for planning purposes, a recce flt with three Skeeters should be able to get 90 flying hrs out of its Skeeters in one month.
- The Alouette and Scout both have a gas turbine engine.

PERFORMANCE DETAILS OF CURRENT STRATEGIC TRANSPORT (ST) AC  
(TEMPERATE CLIMATE)

RAF ST AC

Ac Type (a)	Max Payload /Range (b)	Max Range /Payload (c)	Cruise Speed (d)	Max Tps (e)	Max Stretchers (f)	Cargo Compartment (g)	Notes (h)
Britannia	31,700 lbs /2,600	3,600 /20,000 lbs	300	110	53	68' x 6' x 10'	1. Ferry Range, 4,000 nm. +
Comet 2	11,500 lbs /1,500	1,780 /5,900 lbs	400	44	6	Pax only	1. Ferry Range, 1,950 nm.
Comet 4C	20,000 lbs /1,800	2,600 /8,000 lbs	410	94	12 (8 per normal op)	Pax only	1. Ferry Range, 2,800 nm.
VC 10	53,000 lbs /3,300	4,060 /30,000 lbs	460-490	150	36	Length 80' 4" (galley removed) Width 10' 7" tapering at rear to 9' 8" Height 7' 7"	1. Ferry Range, 5,000 nm. 2. Fit refuelling receiver capability.
Belfast	77,500 lbs /480	2,600 /30,000 lbs	250	147	NIL	Length 63' 4" + 21' 8" ramp either Width 10' Height 12' or Width 12' Height 11' Max Height 13' 4"	1. Ferry Range, 3,500 nm. 2. Fit refuelling receiver capability.

Notes:

1. The range payload figures will have to be adjusted for local effects of temperature, height of airfield and humidity. In addition, the WAT (Weight and Temperature Limitation) factor, will on occasions limit the payload to enable the ac to take off in accordance with the regulations for fit to full safety standards.
2. The difference between the max range shown in colm (c) and the ferry range quoted under the last colm are caused by ac structural limitations, ie the extra fuel to achieve max ferry range prevents a payload being carried.
3. The Comet 2 is due to be withdrawn from svc in 1967.



PERFORMANCE DETAILS OF CURRENT TACTICAL TRANSPORT (TAC T) AC  
(TEMPERATE CLIMATES)

Ac Type (a)	Max Payload /Range (b)	Max Range /Payload (c)	Radius of Action /Payload (d)	Cruise Speed (e)	Tps (f)	Para (g)	Stretchers (h)	Sup Dropping Capability (i)	Cargo Compartment
Beverley	31,300 lbs /300	2,050 /NIL	750 nm /10,000 lbs	155	94	70 (60)	48	1-ton - 16 H/D - 1 MSP - 2 SSP - 4	40' x 10' x 10'
Hastings	14,500 lbs /1,150	2,320 /4,300 lbs	750 nm /11,500 lbs	205	44	30	32	SEAC PACKS AB Panniers HARNESSE PACKS	42' 6" x 9' x 6' 6"
Argosy	26,900 lbs /180	1,660 see notes 3 and 4 /3,250 lbs	750 nm /5,000 lbs	220	69	50 (42)	48	1-ton - 8 H/D - NIL MSP - 2 SSP - 4	47' x 6' 8" (8' 6" for the rear 15') x 10' see note 2
C-130K	45,000 lbs /2,200	4,000 /20,000 lbs	-	300	92	64	74	-	41' x 10' 3" x 9'

## Notes:

- The range payload figures must be adjusted for local effects of temperature, height of airfield and humidity. In addition the WAT (Weight and Temperature Limitation) factor, will on occasions, limit the payload to enable the ac to take off in accordance with the regs for flt to full safety standards.
- The Argosy fuselage is constricted.
- The Argosy has an in flt refuelling capability.
- The Argosy can be fitted with long range tks.
- In colm (g) the unbracketed para figure for Beverley and Argosy ac is the max number which can be carried. The bracketed figure is the normal op load for tac drop.
- C-130K (Hercules) is due in svc in 1967.

PERFORMANCE DETAILS OF CURRENT TAC T AC AND HELLS (CONT.)  
(TEMPERATE CLIMATES)

RAF TAC T AC AND HELLS

Ac Type	Range/Payload		Ferry Range	Max Loads	Cruise Speed	Type	Para	Stretchers	1-ton Containers	Pounds Hook
	Radius of Action 50 nm	Radius of Action 100 nm								
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)
Single Pioneer	1,000 lbs	1,000 lbs	850	1,000 lbs	70	4	MIL	1	-	NA
Twin Pioneer	3,080 lbs	2,800 lbs	640	3,080 lbs	85	10	8	9	-	NA
Andover	Normal 12,000 lbs   12,000 lbs STOL 6,000 lbs   5,000 lbs		2,700	12,400 lbs	200	40	25	10	5-6	NA
Belvedere	2,600 lbs (VTO) 3,200 lbs (cushion TO)	1,200 lbs (VTO) 1,700 lbs (cushion TO)	400 (Temp) 360 (Trop) LR Tk	6,000 lbs (internal)	100	18	10	8 (normal) 12 (emergency)	-	5,000
Whirlwind Mk 10	1,000 lbs (VTO) 1,250 lbs (cushion TO)	350 lbs (VTO) 600 lbs (cushion TO)	300	2,000 lbs	80	10	5	6	-	2,000
Wessex 2 and 5	2,550 lbs	1,450 lbs	400 LR Tk	4,000 lbs	90	15	12	8	-	4,000 (Mk 2)

## GLOSSARY OF SIG TERMS

The fol are some of the terms frequently used in connection with comms. Those marked \* are the agreed NATO terms. The more tech ones have been omitted.

<u>Term or Abbreviation</u>	<u>Meaning</u>
ACT	Apparatus Carr Telephone (see Carr Eqpt).
ADPS	Automatic Data Processing Systems. A complete system based on the use of electronic computers for the solution of problems and the storage of info of a mil nature. The term also incis the means of comm between computers and between the input device and the computer when they are separated.
AM	Amplitude Modulation (see Modulation).
*Audio Freq	A freq which can be detected as a sound by the human ear. The range of audio freqs extends from 20 to 20,000 cycles per second.
Bandwidth	All those freqs lying between two particular pts in the freq spectrum. It is usually expressed by the difference between these freqs.
Carr Eqpt	Eqpt which can provide more than one speech channel over a comm system.
CPS	Carr Freq Shift. A method of tg usually found on radio systems, where a sig is transmitted by slightly displacing the fundamental freq on which the eqpt is working.
Channel	A band of freqs which can be used to provide either speech or tg comms between two places.
Channelling Eqpt	See Carr Eqpt. The two are synonymous.
*Cipher, Off-line	A method of encryption which is not associated with a particular transmission system and in which the resulting cryptogram can be transmitted by any means.
*Cipher, On-line	An automatic method of encryption associated with a particular transmission system, whereby sigs are encrypted and passed dir to op the reciprocal eqpt at the distant sta.
*Circuit	An electronic path between two or more pts capable of providing a number of channels.
Circuit, 2-wire	A comm system where the sigs originated at each end use the same path, eg a normal telephone pt to pt link over a cable pair.
Circuit, 4-wire	A comm system where the send and receive dirs of signaling are kept physically or electrically separate.
Crystal Con	The use of the mech and electrical properties of a crystal (quartz or other similar minerals) to con the operating freq of a radio system. This method is noted for its accuracy and stability.
*Cycle	One complete positive and one complete negative alternation of a current or voltage.
*Duplex	The provision of comm between two pts in both dirs simultaneously.
Exchange CB	Central Bty Exchange. An exchange with CB facilities is one where the user lifts his telephone to call an op. The op sees a lamp lit up for the extension concerned. The power to op this lamp is provided from a bty system loc at the exchange.
*Facsimile	A system of telecomm for the transmission of fixed images with a view to their reception in a permanent form.
*FDM	Freq Div Multiplex. A multiplex system in which two or more sigs are transmitted simultaneously over a common path, each sig occupying a different freq band.
Freq	The number of cycles occurring in a fixed period of time, usually one second.
FM	Freq Modulation (see Modulation).

## GLOSSARY OF SIG TERMS (CONT)

<u>Term or Abbreviation</u>	<u>Meaning</u>
Generator	Apparatus for producing AC electricity.
HF	High Freq. Radio freqs between 3 and 30 Mc/s.
Kc/s	Kilocycles per second. Thousands of cycles per second.
Mc/s	Megacycles per second. Millions of cycles per second.
Modulation	Varying a fixed sig with the particular sig to be transmitted. This can be done in a number of ways eg AM varies the amplitude of the fixed sig in dir sympathy with the characteristics of the sig to be transmitted. FM varies the instantaneous freq of the fixed sig in dir sympathy with the characteristics of the sig to be transmitted, etc.
*Multiplex	The simultaneous use of a number of channels on a single circuit.
PM	Pulse Modulation (see Modulation).
Printed Circuit	A production method whereby internal wiring of eqpt is dispensed with and replaced by an insulating material on which lines of metal are etched in such a manner that an electric current can flow to and from components mtd on the material.
RR	Radio Relay. A means of providing by using radio techniques, circuits comparable with line circuits.
Repeater	A device to amplify a sig.
SHF	Super High Freq. 3,000 to 30,000 Mc/s.
*Sideband	The freq band above or below the carr, produced by the process of modulation.
Simplex	The provision of comms in one dir only at any one time.
*Swd Magneto	A manual telephone exchange at which the subscribers and ops call and clear by means of magneto generators.
*Tape Relay	A method of receiving and retransmitting msgs in tape form.
*TDM	Time Div Multiplex. A multiplex system in which the total avai circuit time is divided between the number of channels to be transmitted.
*Telecomm	Telecommunication. Any transmission, emission or reception of sigs, signs, writing, images and sounds or int of any nature by wire, radio, vis or other electro-magnetic systems.
*Tg	A system of telecomm for the transmission of int by the use of a sig code.
*Telephony	A system of telecomm set up for the transmission of speech or, in some cases, other sounds.
Transistor	A device using semi-conductor materials which displays many of the advantages of the thermionic valve but requires less power and is smaller. At the present it suffers from limitations of freq and power handling capacity.
UHF	Ultra-High Freq. 300 to 3,000 Mc/s.
.Watt	A unit of power. A powerful electric lt bulb uses 100 watts. A single bar electric fire uses about 1,000 watts.
Wavelength	The distance, usually measured in metres, between any two adjacent identical pts on a waveform.
VF	Voice Freq, ie audio freq tones.
VHF	Very High Freq. 30 to 300 Mc/s.
Yagi Antenna	A particular type of directional antenna to handle VHF sigs.

## FD RADIO AND RR RCPT

## FD RADIO AND RR RCPT

Serial (a)	Set (Note 1)	Replac- ing	Principal Role	Other Roles	System	Freq Coverage (Mc/s)	Range (miles) (Note 3)		Number of Channels	Weight (lbs) excl RVA	Remarks
							Day	Night			
1. A510	(b)	(c)	Inf. Pl/coy in special conditions)	-	AM	2-10	Voicg. 5 Tg. 11		3 4 5	20 (incl dry miles kg may be obtained by)	Channels are pre-set crystal con. Skywave ranges of up to 40 miles voice and 120 miles kg may be obtained by. Direct choice of antennae for this replacement set for this role has been developed.
2. 62		-	Para.	--	AM	6-10	Voicg. 15		-	23	HF set with greater range aval.
3. A13		62	Inf. For unit cond nets when VHF unsuit- able.	-	AM or PM	2-8	Voicg. 12 Tg. Up to 200 (sky- wave)		20	2.5 Kc/s free tuning crystal cal. no netting	HF set with greater range aval.
4. A14		-	Ado and Para BN.	-	AM or PM	2-8	Voicg. 15		5	32 (incl 9 kg)	Long-range ptl set for use in jungle and similar diffi- cult terrain.
5. A16	A510		Plt. Sel.	-	AM	2-8	Voicg. 3-50 Tg. 300		3-50 300	9 voice 45 kg	Basic HF set for R SIGNALS. Transmitter only. R210 is associated receiver and weights 35 lbs. Certain links are adapted to use teleprinters.
6. C11		-	R SIGNALS. Comd nets in div and bde HQ to VHP	R SIGNALS. Regt rear links. HF radio links to VHP Some 5Vc	AM	2-16	Voicg. 25 Tg. 50		18 35	Free tuning	Current HF set for all arms use. Same size and connectors as G42 and G45. Can work to C13 HP on PM. Airtbl in AIRTEC containers.
7. C13	C12		RAC. Armd car regt - within sqns	APX. CH comms. Regts (40/ 70/FCH7) SQCS. LOs and SIGCS. LOs and SQCS et div and bde HQ	AM or PM	1.5-12	Voicg. 20 Tg. 40		15 30	Free tuning	Can not work on AM. Can therefore only work to another C13 HP or C13 (low power). Airtbl in AIRTEC containers. set (Redifon CR 410) bought in small quantities.
8. C13 HP	-	-	RAC. Armd car regt net	Some engr nets	PM	1.5-12	Voicg. 40 Tg. 80		30 50	Free tuning	
9. C14	-	-	AB. Forma- tion rear links	Special issue in FARELIF	AM	3.18	300			4 spot frags (8 SSB chan- nels)	

FD RADIO AND RR REPORT (CONT)

Serial	Set (Note 1)	Replac- ing	Principal Role	Other Roles	System	Freq Coverage (Mc/s)	Range (miles) (Note 3)	Number of Channels	Weight (lbs) excl. Pkts	Remarks
(a)	(b)	(c)	(d)	(e)	(f)	(g)	Day (h) Night (i)	(j)	(k)	(l)
10.	D15	-	Admin. Information nets	Special Issue for strat res.	AM	2-30	80 groundwave 500 skywave	1 Kcs channel spacing	185	A commercial sat (Collins VC 182) bought in small quantities.
11.	D11	53	Formation Admin nets down to div	-	AM	2.1-20	Voice. 35/70 TL. 100	Free tuning	500	Carried in trucks 1-top Skywave ranges up to 1,500 miles using suitable antennae. Teleprinters can be op over it.
12.	D13	-	R STONALE. Army gp sig regts, link rear and in front of COMCAN	-	AM	2.1-22	Voice. 50/100 TL. 150	Free tuning	2 x 1-ton vehs	Skywave ranges up to 2,000 miles using suitable antennae. COMCAN - Commonwealth Comms Army Network.
13.	A40	88	Inf. Pl/coy. Sect/pl	Inf. Pl/coy/ Sect to tks.	FM	47-55	1+	6 (pre-set)	8 (incl dry bty)	Voice only. Whistler facility. Based on Canadian set (GPG 28). Sets issued as Type A and Type B each having 3 excl channels and 3 common channels.
14.	A41	31	Inf. Coy/bn. Pl/coy	Inf. Pl/coy/ bn to tks. Mortar pl. Arty. FOO to Inf.	FM	38-55	3	170	22 (incl dry bty)	Voice only. Facilities for remote op and remote antenna. Range can be increased using elevated antennae.
15.	A42	38	Arty. FOO's Sgt	-	FM	28-38	3	120	22 (incl dry bty)	Identical to A41 apart from freq coverage.
16.	A43	-	All Arms Ground/Air.	Arty. Naval gunfire obsn parties. Inf. ops ship to shore.	AM	Type R 244-300	45 at 5,000 ft optical difference	6 (pre-set)	30 (incl bty)	Voice only. Manpack. Uses re-chargeable bty or will op from 12 v DC sup and is suitable for veh instl. Whip and elevated antennae.

## FD RADIO AND RR EQPT (CONT)

Serial	Set (Note 1)	Replac- ing	Principal Role	Other Roles	System	Freq Coverage (Mc/s)	Range (miles) (Note 3)		Number of Channels	Weight (lbs) excl RTVS	Remarks
							Day	Night			
17.	B47	(a) (b) (c) 88 AFV 31 AFV	(d) RAC. Arm and arm car regts for comms with inf	(e) Misc. Lia ison ac.	(f) FM	(g) 35-56	(h) 5/7	(i) 5/7	(j) 175	(k) 30	(l) Voice only. Ground to air range 10/20 miles.
18.	B48	38	ARMY. OP with inf	ARMY. Air of set.	FM	28-35	5/7	5/7	120	30	Identical to B47 apart from freq coverage.
19.	C41	-	R SIGNALS. Bde sig squads, div and corps RR regts. RR eqpt	R SIGNALS. CommZ area.	FM	50-100	Near optical	Near optical	12 simul- taneous in con- junction with carr eqpt	240	
20.	C42	-	R SIGNALS. Formation comd nets. All ARMS Unit comd nets.	Misc. APC comms.	FM	35-60	10/15	10/15	240	90	Voice only. Elevated antennae can be used range of 25 miles when static. Range can be much increased by use of rebroad- cast. Tg adaptor avail.
21.	C45	-	R SIGNALS. Army comd nets Regis Army.	-	FM	23-38	10/15	10/15	150	90	Voice only. Similar to C42 but lower freq range. Facilities for remote op and remote antenna. Can work automatic rebroadcast with B48.
22.	C48	-	R SIGNALS. Air sp tentacle ground to air	-	AM	225- 399.9	Line of sight	Line of sight	Freq tuning of 100 KC/s spacing	80	Based on US ac set AN/APC-52 in a more robust mounting for veh use. Limited issue only for BAOR.
23.	C50	-	Trunk RR div	-	FM	225-400	25	25	12	380	
24.	C70	-	Trunk RR div corps to	-	FM	410-960	25	25	12	400	

## FD RADIO AND RR EQPT (CONT)

Serial	Set (Note 1)	Replac- ing	Principal Role	Other Roles	System	Freq Coverage (Mc/s)	Range (miles) (Note 3)	Number of Channels	Weight (lbs) and Rys	Remarks
(a)	(b)	(c)	(d)	(e)	(f)	(g)	Day	(h)	(i)	(j)
25.	ARC 44	-	Air to ground in unit hals	-	FM	24-51.9	50 miles max. No change at height	280	25	(1)
26.	B70	-	R SIGNALS RR feeder circuits.	-	FM	4,550-4,630	Line of sight	4 simultaneous in conjunction with set eqpt	120	May accept up to 12 simultaneous channels.

Notes: (these apply to pages 324, 325, 326 and 327)

1. Nomenclature of Radio Sets. Radio sets are designated by a ltr and a two figure number, eg A41.

a. Ltr. Indicates power consumption and gives some indication of the size of the eqpt:

Ltr	Power Consumption	Typical Size
A	Below 10 watts	Manpack
B	10-100 watts	Manptbl
C	100 watts-1 kilowatt	Vehicular
D	1-10 kilowatts	Mob or transptbl
E	Above 10 kilowatts	Transptbl or static

b. Number. Indicates the freq band in which the set operates:

Number	Freq Band	Wavelengths
10-39	(MF) 300 Kc/s (HF) 3 Mc/s	1,000 m 100 m
40-69	(VHF) 30 Mc/s (UHF) 300 Mc/s	10 m 1 m
70-99	(SHF) 3,000 Mc/s 30,000 Mc/s	10 cms 1 cm

2. Only sets in the same freq band and using the same method of modulation can inter-op.

3. Range depends on type of antenna used. Figures given are those for vertical rod of average height. With HF sets, greater ranges can be obtained by using horizontal wire antennae.



# FREQ OVERLAP

## FREQ OVERLAP OF VHF RADIO SETS

Arm	Set	Purpose	20	30	40	50	60
Arm'd	B47	Tk/arm'd car/APC - dismt'd inf					
					38	Five/Seven	56
Arty	C42	Regt comms			36	Ten/Fifteen	60
	A41	P00 - inf			38	Three	55
	A42	Dismt'd P00 - OP veh (C45/B48)		26	Three	38	
	B48	Relay set for dismt'd P00 when range of A42 alone insufficient		26	Five/Seven	38	
	C45	Regt comms		23	Ten/Fifteen	38	
	C42	OP - tks (CS regt (105 mm SF) only) - formation nets					
	A40	a. Pl to sect/coy to pl b. Coy/pl/sect - arm'd (B47)			36	Ten/Fifteen	60
	A41	a. Bn - coy/coy - pl b. Bn/coy/pl - arm'd (B47)				One and a quarter	55.4
Inf	C42	Bn - coy when range of A41 insufficient			38	Three	55
				36		Ten/Fifteen	60

### Notes:

1. Apart from freq coverage, fol sets are identical: A41 and A42; B47 and B48; C42 and C45.
2. Freqs avail for allotment are one per 100 Kc/s (one tenth of a Mc) for each set except A40 which has six pre-set crystal channels. See later models of C42 have 50Kc/s separation.
3. A40 is also used by sp tp of arm'd car regt; engrs use C42 for sqn comms and A40 and A41 for comms to inf.

# TELEPHONES AND SWBDS

## TELEPHONE

Serial	Type	Detail
1.	F	The normal mil desk telephone.
2.	L	The lineman's telephone.
3.	J	Standard fd telephone. Tropicalised improved version of telephone L.
4.	H	Sound powered, no btys.
5.	<u>Future Development</u> Telephone Hand Sound Powered No 1	Sound powered, no btys. Under consideration for gen adoption within the inf bn. Range much greater than telephone H.
6.	Gen Purpose Telephone Handset	To replace all existing types except telephone F.

## SWBDS

Serial	Level Used	Present Eqpt		Future Eqpt
		Swbd	Telephone	Automatic Swbd
1.	Bn/regt	10 line	J, F	
2.	Bde	40 line F and F and 10 line magneto	J, F	40/160
3.	Div	80 line	J, F	40/160 line x 2
4.	Corps	120 line	J, F	40/160 line x 3
5.	Army gp	120 line	F	a. Trunk CB20 x 4 b. Satellite 40/160 x 3

FD CABLES

FD CABLES  
(TIMES OF CONST ARE FOR GOOD CONDITIONS, IN OPEN COUNTRY, IN DAYLIGHT)

Serial	Type of Cable	Speech Range in Miles (unloaded)	Det for Laying	Speed of Const	Remarks
1.	Cable, electric, D10 (28 lbs/4 mile coil)	10	a. 1 or 2 men on foot. b. 8 linemen, 2 x 4-ton and tlrs, 1 x 1-ton truck.	2 mph 4 mph	Wound in dispenser coils like balls of string. This allows fast laying and laying by ac or hel.
2.	Cable, electric, fd quad	20	10-20 linemen 1 x 4-ton and tlr 2 x 1-ton trucks 1 x 3-ton truck (This det is for poled route and can be reduced when cable is laid on the ground)	<u>Poled</u> 3/4 mph <u>Ground</u> 2 mph	Used for RR tails and heavier types of routes in rear of div. Obsolescent.
3.	Cable, electric, carr quad, Type P Mk III (140 lbs/4 mile drum)	23	Similar to Serial 2		Primarily for use with multi-channel systems. Lengths are joined by couplers supplied with each cable coil. Loading pots to give increased range can be inserted between couplers.
4.	<u>Future Developments</u> Cable, electric, lt weight, quad (55 lbs/4 mile coil)	19	Similar to Serial 2		Replaces cable at Serial 2 in its gen purpose employment and as RR tails lighter than Serial 2.
5.	Cable, electric, 10 pair (plastic) (150 lbs/4 mile drum)	24	Similar to Serial 2		Cable for fd use, primarily for local distr and inter-connection of echs of a HQ.