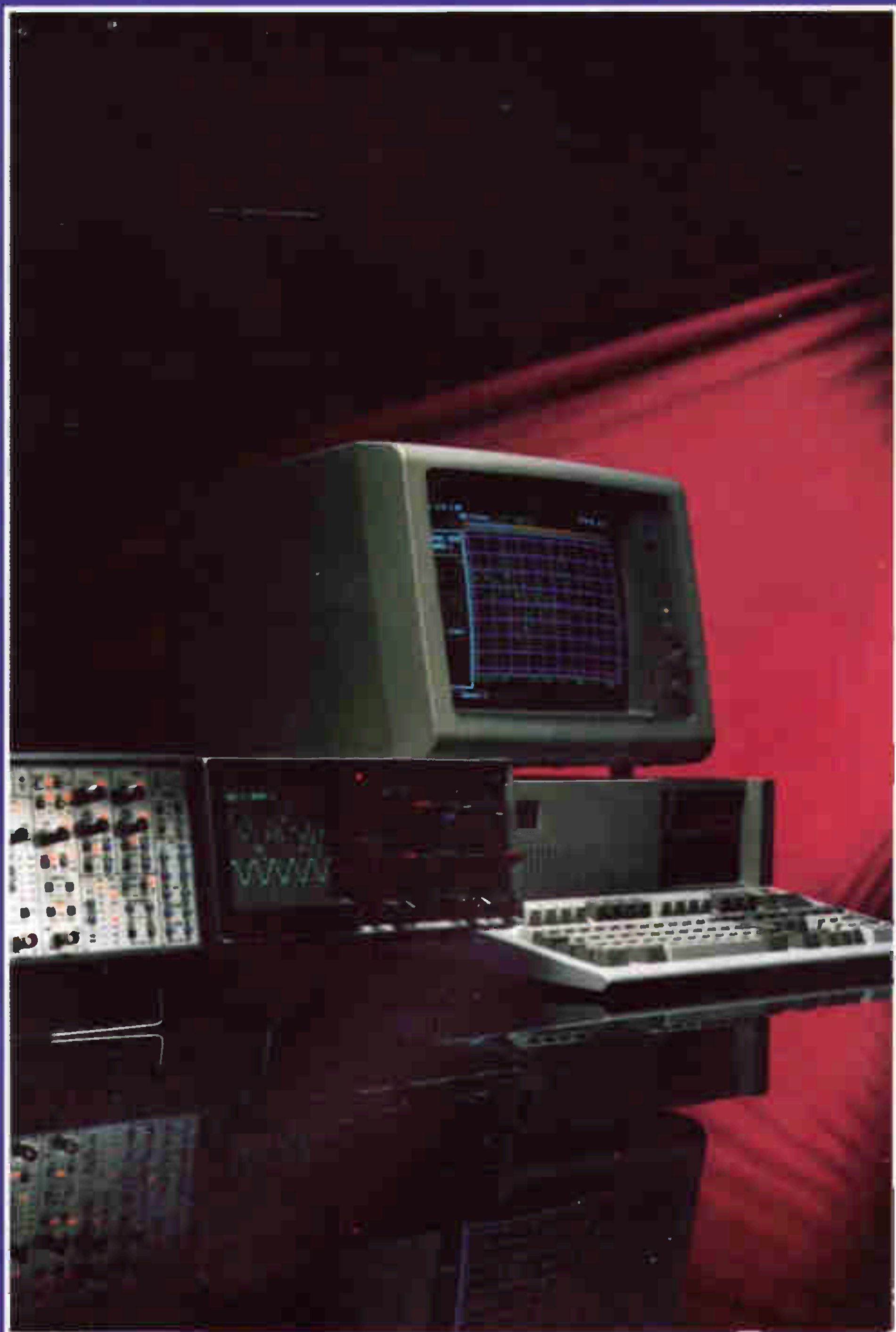
NOVEMBER 1988 £1.75

Radio & Electronics World

The communications and electronics magazine



MEDIUM WAVE DXING: CHOOSING A SUITABLE RECEIVER

AVIATION ELECTRONICS: SPACE: THE FINAL FRONTIER

AMATEUR RADIO WORLD

SHORT WAVE NEWS

ATV ON THE AIR

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ON THE COVER

This month's cover features the DX-PC link software package from Thurlby Electronics. The software package interfaces a Thurlby DSA524 or DSA511 digital storage adapter to an IBM compatible computer.
Full details on (0480) 63570

Editorial
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Safety in the shack

Some of the constructional projects featured refer to additions or modifications to equipment; please note that such alterations may prevent the item from being used in its intended role, and also that its guarantee may be invalidated.

When building any constructional project, bear in mind that sometimes high voltages are involved. Avoid even the slightest risk – safety in the shack please, at all times.

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Radio & Electronics World
The communications and electronics magazine

ADVERTISING RATES & INFORMATION

DISPLAY AD RATES

depth mm x width mm	ad space	1 issue	3 issues	6 issues	12 issues
			series rates for consecutive insertions		
61 x 90	⅛ page	£91.00	£86.00	£82.00	£73.00
128 x 90 or 61 x 186	¼ page	£160.00	£150.00	£145.00	£125.00
128 x 186 or 263 x 90	½ page	£305.00	£290.00	£275.00	£245.00
263 x 186	1 page	£590.00	£560.00	£530.00	£475.00
263 x 394	double page	£1140.00	£1070.00	£1020.00	£910.00

COLOUR AD RATES

depth mm x width mm	ad space	1 issue	3 issues	6 issues	12 issues
		colour rates exclude cost of separations	series rates for consecutive insertions		
128 x 186 or 263 x 90	½ page	£420.00	£395.00	£375.00	£335.00
297 x 210	1 page	£810.00	£760.00	£730.00	£650.00

SPECIAL POSITIONS

Covers: Outside back cover 20% extra, inside covers 10% extra
Bleed: 10% extra [Bleed area = 307 x 220]
Facing Matter: 15% extra

DEADLINES

*Dates affected by public holidays

issue	colour & mono proof ad	mono no proof and small ad	mono artwork	on sale thurs
Sep 88	14 Jul 88	20 Jul 88	22 Jul 88	11 Aug 88
Oct 88	11 Aug 88	17 Aug 88	19 Aug 88	8 Sep 88
Nov 88	15 Sep 88	21 Sep 88	23 Sep 88	13 Oct 88
Dec 88	13 Oct 88	19 Oct 88	21 Oct 88	10 Nov 88

CONDITIONS & INFORMATION

SERIES RATES
Series rates also apply when larger or additional space to that initially booked is taken.
An ad of at least the minimum space must appear in consecutive issues to qualify for series rates.
Previous copy will automatically be repeated if no further copy is received.
A 'hold ad' is acceptable for maintaining your series rate contract. This will automatically be inserted if no further copy is received.
Display Ad and Small Ad series rate contracts are not interchangeable.

If series rate contract is cancelled, the advertiser will be liable to pay the unearned series discount already taken.

COPY
Except for County Guides copy may be changed monthly.
No additional charges for typesetting or illustrations (except for colour separations).
For illustrations just send photograph or artwork.
Colour Ad rates do not include the cost of separations.

Printed — web-offset

PAYMENT
Above rates exclude VAT.
All single insertion ads are accepted on a pre-payment basis only, unless an account is held.
Accounts will be opened for series rate advertisers subject to satisfactory credit references.
Accounts are strictly net and must be settled by publication date.

FOR FURTHER INFORMATION CONTACT
Radio & Electronics World, Sovereign House, Brentwood, Essex CM14 4SE.
(0277) 219876

Overseas payments by International Money Order.
Commission to approved advertising agencies is 10%.

CONDITIONS
10% discount if advertising in both Radio & Electronics World and Amateur Radio. A voucher copy will be sent to Display and Colour advertisers only.
Ads accepted subject to our standard conditions, available on request.

P.M. COMPONENTS LTD

PHONE 0474 60521
FAX NO.0474 333 762

SELECTRON HOUSE
SPRINGHEAD ENTERPRISE PARK, SPRINGHEAD ROAD
GRAVESEND, KENT DA11 8HD

TELEX 966371 TOS PM

A SELECTION FROM OUR STOCK OF BRANDED VALVES (Contd)

DL35	2.50
DL63	1.00
DL70	2.50
DL73	2.50
DL91	3.95
DL92	1.25
DL93	1.10
DL96	2.50
DLS10	13.50
DLS16	10.00
DM70	3.95
DM160	6.50
DOD-006	79.50
DY51	1.50
DY86/87	0.75
DY802	0.85
E55L	49.50
E80CC	19.50
E80CF	12.50
E80F	18.50
E80L	29.50
E81CC	5.50
E81L	12.00
E82CC	4.50
E83CC	4.50
E83F	5.50
E86C	9.50
E88C	7.95
E88CC	3.50
E88CC Mullard	4.95
E88CC-01	6.95
E90CC	7.95
E90F	7.95
E91H	4.50
E92CC	3.95
E99F	6.99
E130L	16.50
E180CC	9.50
E180F	6.50
E182CC	9.00
E186F	8.50
E188CC	7.50
E235L	12.50
E280F	19.50
E283CC	12.00
E288CC	17.50
E810F	25.00
E1148	1.00
EA50	1.00
EA52	55.00
EA76	1.95
EA79	1.95
EABC80	1.50
EAC91	2.50
EAF42	1.20
EB34	1.50
EB41	3.95
EB91	0.85
EBC33	2.50
EBC41	1.95
EBC81	1.50
EBC90	1.95
EBC91	1.95
EBF80	0.95
EBF83	0.95
EBF89	0.70
EC95	7.00
EBL1	4.50
EBL21	4.50
EC52	0.75
EC70	1.75
EC81	7.95
EC86	1.95
EC88	1.95
EC90	1.50
EC91	5.50
EC93	1.50
EC95	7.00
EC97	1.10
EC8010	12.00
ECC32	3.50
ECC33	3.50
ECC35	3.50
ECC81	1.50
ECC81 Special quality	2.25
ECC82	0.85
ECC82 Philips	1.95
ECC83	0.95
ECC83 Brimar	2.15
ECC83 Philips	1.95
ECC83 Siemens	2.50
ECC83S	3.50
ECC85	1.00
ECC86	2.75
ECC88	1.00
ECC89	1.50
ECC91	2.00
ECC189	2.50
ECC801S	6.95
ECC803S	6.95
ECC804	0.60
ECC2000	7.95
ECF80	1.15
ECF82	1.15
ECF86	1.70
ECF200	1.85
ECF202	1.85
ECF801	0.85
ECF804	6.50
ECF805	2.50
ECF806	10.25
ECH3	4.50
ECH4	4.50
ECH35	3.50
ECH42	1.50
ECH81	1.75
ECH83	1.00
ECH84	1.00
ECH200	1.50
ECL80	0.60
ECL82	1.00
ECL83	2.50
ECL84	0.74

ECL85	0.95
ECL86	0.95
ECL805	0.95
EF37A	2.50
EF39	1.50
EF40	4.50
EF42	3.50
EF50	2.50
EF54	4.50
EF55	4.95
EF70	1.20
EF73	3.50
EF80	0.55
EF83	3.95
EF85	0.50
EF86	2.25
EF86 Mullard	4.50
EF86/CV4085	6.00
EF89	1.50
EF91	1.95
EF92	2.15
EF93	1.50
EF94	1.50
EF95	1.95
EF86/CV4085	5.00
EF97	0.90
EF98	0.90
EF183	0.75
EF184	0.85
EF731	4.50
EF800	11.00
EF804S	19.50
EF805S	25.00
EF806S	25.00
EF812	0.65
EFL200	1.50
EFP60	3.50
EH90	0.72
EK90	1.50
EL32	0.95
EL33	5.00
EL34	2.95
EL34 Siemans	4.50
EL36	2.50
EL36 Mullard	3.95
EL37	9.00
EL38	9.00
EL41	3.50
EL42	2.00
EL509 Mullard	7.50
EL71	4.50
EL81	6.95
EL83	7.50
EL84 Mullard	3.50
EL84 Siemans	2.50
EL85	4.50
EL86	1.75
EL90	1.75
EL91	6.00
EL95	1.75
EL152	15.00
EL360	6.75
EL500	1.95
EL504	1.95
EL506	5.95
EL509	5.25
EL519	6.95
EL802	3.65
EL821	6.95
EL822	12.95
ELL80	22.50
EM34	12.50
EM83	1.65
EM84	1.65
EM85	3.95
EM87	2.50
EN32	15.00
EN91	1.95
EN92	4.50
EY51	0.80
EY70	7.50
EY81	2.35
EY82	1.15
EY83	1.50
EY84	5.95
EY86/87	0.50
EY88	0.85
EY91	5.50
EY500A	1.50
EY802	0.70
EZ35	1.00
EZ40	2.75
EZ41	2.75
EZ80	0.75
EZ81	0.75
EZ90	1.50
FW4-800	2.95
G55/1K	9.00
G180/2M	6.95
G240/2D	9.00
GC10B	17.50
GC10D	17.50
GC10/4B	17.50
GC10/4E	17.50
GC12/4B	17.50
GD86W	6.00
GDT120M	5.00
GN4	6.00
GN10	15.00
GR10G	4.00
GS10C	16.50
GS10H	12.00
GS12D	12.00
GT1C	14.00
GU20	35.00
GU50	17.50
GXU1	13.50
GXU3	24.00
GXU50SS	14.50

GY501	1.50
GY802	1.50
GZ32	2.50
GZ233	4.50
GZ234	2.50
GZ237	4.50
HBC90	1.95
HF93	2.50
HL41	3.50
HL90	3.50
HL13DD	3.50
KT8C	7.00
KT33C	3.50
KT36	2.00
KT44	4.00
KT45	4.00
KT61	5.00
KT63	2.00
KT66 USA	9.95
KT66 GEC	25.00
KT67	9.00
KT77 Gold lion	11.95
KT81	7.00
KT88 USA	10.95
KT88 Selectron	15.00
KT88 GEC	22.50
KTW61	2.50
KTW62	2.50
KTW63	2.00
KTZ63	2.50
LB7-20	95.00
LS9B	6.95
M508	195.00
M5143	155.00
M5199	295.00
M8079	6.00
M8082	7.50
M8083	3.25
M8091	7.50
M8096	3.00
M8098	5.50
M8099	5.00
M8100	5.50
M8136	7.00
M8137	7.95
M8161	6.50
M8162	5.50
M8163	5.50
M8190	4.50
M8195	6.50
M8196	5.50
M8204	5.50
M8223	4.50
M8224	2.00
M8225	3.95
ME1400	3.50
ME1401	29.50
ME1402	29.50
MHLD6	4.00
MS4B	5.50
MU14	3.50
N37	12.50
N78	9.85
OA2	1.50
OA2WA	2.50
OA3	2.50
OB2	1.50
OB2WA	2.50
OC3	2.50
OD3	2.50
OM4	2.50
	10.95
KT88 Selectron	17.50
KT88 Gold lion	18.95
KTW61	2.50
KTW62	2.50
KTW63	2.00
KTZ63	2.50
LB7-20	95.00
LS9B	6.95
M508	195.00
M5143	155.00
M1599	295.00
M8079	6.00
M8082	7.50
M8083	3.25
M8091	7.50
M8096	3.00
M8098	5.50
M8099	5.00
M8100	5.50
M8136	7.00
M8137	7.95
M8161	6.50
M8162	5.50
M8163	5.50
M8190	4.50
M8195	6.50
M8196	5.50
M8204	5.50
M8223	4.50
M8224	2.00
ME1400	3.50
ME1401	29.50
ME1402	29.50
MHLD6	4.00
MS4B	5.50
MU14	3.50
N37	12.50
N78	9.85
OA2	1.50
OA2WA	2.50
OA3	2.50
OB2	1.50
OB2WA	2.50
OC3	2.50
OD3	2.50
OM4	2.50

OM5B	3.00
OM6	1.75
ORP43	2.50
ORP50	3.95
P61	2.50
P41	2.50
PABC80	0.75
PC86	0.75
PC88	0.75
PC97	1.10
PC900	1.25
PCC84	0.40
PCC85	0.55
PCC88	0.70
PCC89	0.70
PCC189	0.70
PCC805	0.70
PCC806	0.80
PCE82	0.80
PCF80	0.65
PCF82	0.60
PCF84	0.65
PCF86	1.20
PCF87	1.25
PCF200	1.80
PCF201	1.80
PCF801	1.35
PCF802	0.85
PCF805	1.25
PCF806	1.00
PCF808	1.25
PCH200	1.50
PCL82	0.85
PCL83	2.50
PCL84	0.75
PCL85	0.80
PCL86	0.85
PCL805	0.90
PD500	5.95
PE1-100	69.00
PEN25	2.00
PEN40DD	3.00
PEN45	3.00
PEN45DD	3.00
PEN46	2.00
PFL200	0.95
PL36	1.75
PL38	1.50
PL81	1.25
PL82	0.60
PL83	0.52
PL84	0.78
PL500	1.10
PL504	1.15
PL508	1.75
PL509	4.85
PL519	4.95
PL802	6.00
PL802T	3.50
PL820	2.95
PY32	0.60
PY33	0.50
PY81	0.70
PT82	0.70
PY83	0.70
PY88	0.65
PY500A	1.95
PY800	0.79
PY801	0.79
QB3-300	72.00
QB3-1750	139.50
QB5-3500	595.00
QE03-10	4.95
QQE02-5	19.50
QQE03-12	7.95
QQE03-20	35.00
QQE06-40	45.00
QQV02-6	19.50
QQV03-10	5.50
QQV03-10 Mullard	15.00
QQV03-20	25.00
QQV06-40A	27.50
QQV06-40A Mullard	39.50
QQV07-50	55.00
QQZ03-20	42.50
QQZ06 40	45.00
QS75/20	1.50
QS75/40	3.00
QS92/10	5.00
QS95/10	4.85
QS108/45	4.00
QS150/15	6.95
QS150/30	1.15
QS150/40	7.00
QS1200	3.95
QS1202	3.95
QS1203	4.15
QS1205	3.95
QS1209	3.15
QS1212	3.20
QS1213	5.00
QS1218	5.00
QU37	9.50
QV03-12	6.50
QV06-20	29.50
QV08-100B	145.00
QY3-125	72.00
QY4-250	72.00
QY4-400	85.00
R10	4.00
R11	4.50
R16	12.00
R17	1.50
R18	2.50

R19	2.50
R20	1.20
R1169	55.00
R5559	9.50
RG1-125	4.95
RG1-240A	14.50
RG3-250A	6.50
RG3-1250A	35.00
RK2K25	62.50
RPY18	2.50
RPY43	2.50
RPY82	2.50
RR3-250	15.00
RR3-1250	35.00
S6F17	5.95
S6F33	28.95
S11E12	38.00
S30/2K	8.50
S104/1K	10.00
S109/1K	15.00
S130P	5.95
SC1/800	5.00
SC1/1100	6.00
SC1/1200	5.00
SC1/1300	6.00
SC1/1400	6.00
SP41	5.00
SP61	3.50
ST11	5.00
STV280/40	11.95
SU42	4.95
TB2-5/300	95.00
TB2-300	195.00
TB3-750	115.00
TB3-2000	450.00
TBL2-300	395.00
TBL2-500	495.00
TC04/10-02	45.00
TD03-10E	35.00
TD03-10F	35.00
TDD2A	4.95
TH328	850.00
TH2321	4.95
TP2620	5.50
TT11	1.50
TT15	45.00
TT21	45.00
TT22	39.50
TT100	69.00
TTR-31MR	65.00
TY2-125A	85.00
TY4.400	85.00
TY7-6000A	600.00
TY8-600W	365.00
TYS2/250	375.00
U18-20	2.75
U19	11.95
U24	2.00
U25	0.90
U26	0.90
U35	3.50
U37	9.00
U41	6.95
U50	2.00
U82	3.00
U191	0.70
U192	1.00
U193	1.00
U251	2.50
U801	3.50
UABC80	1.00
UAF42	1.95
UBF80	0.60
UBC41	3.95
UBC81	1.50
UBF89	1.00
UBL21	1.75
UC92	1.20
UCC84	0.70
UCC85	0.60
UCF80	1.00
UCH21	2.50
UCH41	2.50
UCH42	3.95
UCH81	1.00
UCL82	1.75
UCL83	2.50
UF41	2.25
UF42	2.25
UF80	1.75
UF85	1.20
UF89	2.00
UL41	10.00
UL44	3.50
UL84	1.50
UL85	0.85
UU5	3.50
UU6	6.00
UU7	8.00
UU8	9.00
UY41	3.50
UY85	0.70
V235A/1K	250.00
V238A/1K	295.00
V246A/2K	315.00
V2406/1K	225.00
V241C/1K	195.00
V453	12.00
VLS631	10.95
VP4B	9.50
VP41	4.95
VR7-30	3.00
VR101	2.50

VR105/30	2.50
VR150/30	2.50
VU29	4.50
VU39	2.50
W21	4.50
W61	4.50
W77	5.00
W81M	4.50
W729	1.00
W739	1.50
X24	4.50
X41	4.50
X66/X65	4.95
X76M	1.95
XC24	1.50
XC25	0.50
XFW47	1.50
XFW50	1.50
XG1-2500	75.00
XL628FT	7.50
XNP12	2.50
XR1-1600A	49.50
XR1-3200A	79.50
XR1-6400A	149.50
Y65	6.95
YD1100	75.00
YJ1020	42.50
YJ1060	265.00
YL1060	195.00
YL1070	195.00
YL1071	195.00
YL1290	65.00
YL1440	450.00
Z77	1.20
Z300T	6.00
Z302C	12.00
Z359	9.00
Z520M	4.00
Z700U	9.50
Z759	19.85
Z803U	16.95
ZA1000	12.50
ZA1001	1.50
ZM1001	12.00
ZM1005	8.00
ZM1020	6.00
ZM1021	8.00
ZM1023	7.95
ZM1041	14.00
ZM1082	9.00
ZM1084	10.00
ZM1175	6.50
ZM1177	9.00
ZM1202	55.00
ZM1263	4.00
1A3	4.50
1AE4	3.50
1AX2	3.50
1B22	10.00
1B27	55.00
1B35A	45.00
1B63A	75.00
1K3	2.50
1N5GT	2.50
1P28	25.00
1R5	0.90
1S5	1.50
1T4	1.00
1U4	1.75
1U5	1.00
1X2B	2.50
2A3	16.50
2AS15A	11.50
2B7	2.50
2B22	69.50
2C36	70.00
2C39A	32.50
2C39BA	39.50
2C40	37.00
2C42	29.50
2C43	60.00
2C51	2.50
2CY5	1.50
2D21	1.95
2D21W	3.15
2E22	49.00
2E26	7.95
2J55	295.00
2K25	35.00
2K25 Raytheon	75.00
2K26	95.00
2K29	250.00
2K48	140.00
2K56	250.00
2X2A	5.00
3A/107B	12.00
3A/108A	9.00
3A/109B	11.00
3A/110K	12.00
3A/141K	11.50
3A/146J	7.50
3A/147J	7.50
3A167M	10.00
3A3A	3.95
3A4	1.10
3A5	4.50
3AT2	3.35
3B22	25.00
3B24	12.00
3B26	24.00
3B28	16.00
3BZ6	1.50
3C45	39.50
3CX3000A7	650.00
3CY5	1.50
3D21A	29.50
3E22	49.50
3E29	39.50
3EJ7	1.95
3H	0.40
3J 170E	1450.00
3L	0.40
3Q4	2.50
4-65A	75.00

4-250A	85.00
4-400A	87.50
1000A	425.00
4B32	35.00
4B/551B	125.00
4BQ7A	1.75
4BZ6	1.95
4C28	25.00
4C35	145.00
4CX125C Eimac	150.00
4CX250B	45.00
4CX250BM	65.00
4CX250K	115.00
4C250R	125.00
4CX350A	100.00
4CX350F	95.00
4CX1000A	425.00
4CX1500B	475.00
4CX5000A	1000.00
4D21/4-125A	85.00
4D32	125.00
4GS7	2.25
4GV7	2.25
4JC6A	2.95
4KT6	1.50
4X150A	35.00
4X500A	350.00
5A/102D	9.50
5A152M	9.00
5A163K	10.00
5A170K	6.25
5A-180M	9.00
5A-206K	10.00
5AM8	2.15
5AN8	1.20
5B-110M	10.00
5B-254M	14.50
5B-255M	19.50
5B-256M	15.00
5B-257M	15.00
5B-258M	14.50
5C22	125.00
5CL8A	2.50
5J180E	1950.00
5LJ8	2.95
5R4GB	5.50
5R4GY	4.95
5TA	5.95
5T8A	1.95
5U4G	4.50
5U4GB	4.50
5V4G	2.50
5X4	4.95
5Y3GT	1.95
5Z3	4.50
5Z4GT	2.50
6/30L2	0.70
6A203K	9.00
6A7	4.95
6A8	1.50
6AB7	4.50
6AC7WA	2.00
6AG5	2.50
6AG7	1.95
6AH6	3.50
6AJ4	3.50
6AJ7	2.00
6AK5	1.95
6AK6	2.50
6AL5	0.85
6AM4	3.25
6AM5	6.00
6AM6	1.95
6AN5	4.50
6AN8A	4.50
6AQ5	1.75
6AQ8	1.00
6AR5	5.95
6AS5	1.50
6AS6	2.50
6AS7G	4.50
6AT6	1.95
6AT8	1.75
6AU4GT	2.00
6AU5GT	4.50
6AU6	0.95
6AV6	1.95
6AW8A	3.50
6AX4GT	1.95
6AY3B	1.95
6AZ8	4.50
6B8G	1.50
6B10	1.95
6BA6	1.50
6BA7	4.50
6BA8A	3.50
6BC8	0.85
6BE6	1.50
6BG6G	3.00
6BH6	1.95
6BH8	1.50
6BJ6	1.50
6BK4	6.50
6BL6	85.00
6BL8	1.15
6BM6	115.00
6BN6	1.65
6BN8	3.95
6BQ5	0.95
6BQ7A	1.50
6BR7	4.95
6BS7	5.50
6BW6	5.35
6BW7	1.50
6BZ6	2.50
6BZ7	2.95
6C4	1.50
6C5	1.95
6C6	3.50
6C8G	1.50
6C9	4.95
6CA4	4.95

6CA7	3.50
6CB5	3.95
6CB6	1.95
6CD6GA	4.50
6CF6	1.95
6CG7	4.50
6CH6	6.95
6CL6	3.25
6CL8A	1.50
6CM7	2.95
6CS6	0.75
6CS7	0.95
6CW4	8.00
6CX8	2.50
6DC6	2.35
6DJ8	1.00
6DK6	1.50
6DQ5	8.50
6DQ6B	2.50
6DT6A	1.50
6DW4B	3.50
6E5	3.95
6EA7	2.50
6EA8	2.50
6EB8	1.75
6EJ7	0.65
6EM5	2.50
6EM7	2.50
6EV8	1.75
6EV7	2.95
6EW6	1.50
6F1	2.00
6F5	5.50
6F6G	2.50
6F7	5.50
6F13	3.00
6F14	1.00
6F17	2.75
6F23	0.60
6F24	1.25
6F25	1.25
6F28	1.25
6F32	1.25
6F33	12.50
6FH5	6.50
6FH8	5.95
6FL2	4.50
6FQ7	4.50
6GE5	3.95
6GH8A	2.50
6GK6	3.95
6GJ7	0.85
6GM6	2.65
6GS7	2.15
6GV8	0.95
6GW8	2.50
6GY5	4.95
6GY6	2.50
6H1	9.50
6H6	2.50
6H6GT	1.95
6HB7	1.95
6HF8	2.50
6HM5	2.50
6HQ5	3.50
6HS6	4.95
6HS8	2.95
6HZ6	3.50
6J4	2.15
6JAWA	3.15
6J5GT	2.50
6J6	2.00
6J7	4.15
6J7G	4.15
6JB6A	7.95
6JE6C	7.50
6JM6	7.50
6JU8A	2.50
6JS6C	8.50
6K7G	2.00
6K8G	3.00
6KD6	8.95
6KG6A	6.95
6KM8	2.50
6L1	2.50
6L6GC	2.95
GL6GC USA	6.50
6L6GT	2.95
6L6WGC	5.50
6L7	3.50
6L15	3.15
6L19	3.95
6LJ8	2.50
6LD20	1.15
6LF6	7.50
6LQ6	7.50
6P28	2.00
6Q7GT	1.50
6R7	3.15
6RHH8	10.00
6S4A	1.50
6SA7	1.35
6SC7	1.50
6SH7	1.35
6SJ7GT	1.20
6SK7	1.35
6SL7GT	1.95
6SN7GT	1.95
6SQ7GT	1.50
6SS7	1.95
6T8	1.50
6U6GT	3.50
6U7G	3.50
6U8A	1.50
6V6G	1.25
6V6GT	1.95
6W4GT	1.95
6Y6G	3.95
6X2N	1.00
6X4	1.50
6X5GT	1.00
6X5GTY	1.00
6X8A	2.25
7A6	4.50
7AU7	1.50
7B6	3.50
7B7	2.50
7D8	4.50
7J7	5.50
7K7	7.50
7L	1.50
7Q7	4.50

7Y4	2.50
8B8	2.50
8B10	2.50
8BQ5	1.95
8CW5	1.50
8EB8	1.50
8FQ7	1.97
10D2	1.25
10DE7	2.50
10DX8	2.50
10EB8	1.95
10EW7	2.95
10F1	0.75
10GK6	1.95
10P14	2.50
11E3	55.00
11R3	5.50
12A6	3.95
12AD6	1.50
12AE6	5.50
12AH7GT	4.95
12AL5	1.00
12AT6	1.25
12AT7	1.15
12AT7WA	2.50
12AU6	1.50
12AU7	0.85
12AV6	1.95
12AV7	2.50
12AX4GTB	1.50
12AX7	0.95
12AX7WA	2.50
12AX7S	7.95
12AY7	3.95
12B4A	4.50
12BA6	2.50
12BE6	1.95
12BH7A	3.50
12BL6	1.75
12BR3	1.95
12BY7A	3.50
12C8	2.50
12CA5	1.95
12CX6	1.20
12DQ6B	3.50
12DW4A	3.50
12DZ6	3.95
12E1	19.50
12E14	38.00
12FX5	1.95
12GN7	3.95
12HG7	3.95
12J5GT	3.95
12J7GT	3.50
12JZ8	2.95
12K7GT	1.50
12K8Y	1.95
12KU7	1.95
12PE13A	53.00
12S7GT	1.50
12SA7GT	1.95
12SG7	4.75
12SK7	1.95
12SJ7	1.50
12SN7GT	1.85
12SW7	3.50
12SY7	4.50
12X4	1.95
13D7	3.20
13D9	3.20
13DE7	2.50
13DR7	2.95
13E1	145.00
13EM7	3.50
14B6	4.50
14R7	3.50
15E	5.50
16AQ3	1.95
16GY5	2.95
16H	0.40
16L	0.40
17A8	3.50
17AX4GTA	1.95
17BE3	2.50
17DW4A	2.95
17EW8	0.95
17JZ8	4.50
18D3	6.00
18GB5	3.50
19AQ5	3.50
19AU4GT	2.50
19BG6	3.50
19G3	19.50
19G6	9.00
19H4	35.00
19H5	33.50
20CV	9.50
20D1	0.70
20LF6	7.95
20L1	0.95
20P1	0.55
20P4	1.95
20P5	1.15
21JZ6	4.95
21KQ6	4.95
21LU8	3.75
24B1	39.50
24B9	39.50
25BQ6	1.75
25DQ6B	2.95
25L6GT	1.75
29C1	19.50
29KQ6	6.50
30C15	0.50
30C17	0.40
30C18	1.48
30FL2	1.35
30FL12	0.95
30FL13	1.10
30FL14	1.25
30L1	0.45
30L15	0.60
30L17	0.60
30P4MR	1.00
30P12	1.00
30P18	0.60
30P19	1.00
30PL1	2.50
30PL13	0.60
30PL14	1.75
31JS6C	5.50
33A/158M	19.50

35A3	3.95
35A5	4.50
35C5	4.50
35L6GT	2.00
35Z3	1.95
35Z5GT	3.50
38HE7	5.95
40KD6	5.50
42	6.95
47	6.00
50A5	1.50
50B5	1.95
50C5	0.95
50CD6G	1.95
50EH5	1.50
50JY6	2.95
53KU	4.50
75B1	3.50
75C1	4.50
80	4.50
83	8.50
83A1	7.50
85A1	6.50
85A2	2.95
90AV	17.50
90C1	3.50
90CG	17.50
90CV	17.50
91AG	9.00
92AG	19.50
92AV	19.50
95A1	6.50
100E1	10.00
108C1	2.50
150B2	6.50
150C1K	9.00
150C2	2.50
150C4	2.50
185BT	1.50
211	33.50
230D	15.00
231D	15.00
250TH	150.00
307	5.00
328A	15.00
404A-10	0.95
425A5	8.00
436A	35.00
572B	65.00
705A	12.50
708A	8.00
713A	25.00
723A/B	75.00
724A	275.00
725A	275.00
726A	75.00
7027A	7.50
801A	15.00
802	25.00
803	14.95
805	59.00
807	5.50
808	5.95
810	85.00
811	15.00
812A	35.00
813	27.50
813 Philips	35.00
829B	14.50
833A	95.00
843	7.50
866A	8.50
872A	20.00
873	60.00
954	1.00
955	1.00
958A	1.00
1299A	0.60
1626	3.00
1768	95.00
1849	315.00
1927	25.00
2040	25.00
2050	5.95
2050W	6.95
4004A	11.50
4212E	250.00
4212H	250.00
4313C	4.00
4328D	9.00
4471	35.00
4687A	9.50
5544	79.50
5636	5.50
5642	9.50
5651	2.50
5654	1.95
5670	3.25
5672	4.50
5675	28.00
5678	7.50
5687	4.50
5696	4.50
5702	3.50

5704	3.50
5718	6.15
5725	2.50
5726	2.50
5727	2.50
5749	2.50
5750	1.85
5751	2.95
5763	6.50
5814A	3.25
5823	9.50
5829WA	6.50
5840	3.50
5842	11.00
5863	95.00
5886	13.95
5894	39.50
5899	4.50
5963	1.75
5965	2.15
6005	1.85
6021	3.65
6057	3.75
6058	3.95
6059	3.75
6060	2.25
6062	4.50
6063	2.00
6064	3.25
6067	7.00
6072	6.95
6080	8.50
6080WA	9.50
6132	10.50
6136	2.50
6146B	9.50
6146W	12.50
6155	72.00
6156	72.00
6157	2.50
6158	3.20
6189	4.50
6201	6.45
6205	6.95
6211	2.50
6267	4.50
6299	250.00
6350	3.50
6360	4.50
6386	14.50
6442	75.00
6443	7.00
6463	7.50
6550 RCA	15.00
6550 GE	10.95
6688	6.50
6761	12.50
6870	11.50
6883B	9.95
6973	7.95
7025	2.50
7025S	6.95
7027A	8.50
7032	2.00
7036	4.95
7044	6.95
7054	3.95
7059	2.50
7119	9.00
7167	3.95
7189	5.50
7193	7.50
7199	7.50
7247	4.95
7475	5.00
7486	155.00
7527	85.00
7551	8.50
7558	9.45
7581A	9.95
7586	15.00
7587	19.50
7591A	6.95
7609	47.00
7698	75.00
7699	25.00
7788	25.00
7815	59.50
7868	7.50
7895	17.50
7963	7.95
8005	95.00
8020	45.00
8136	2.15
8156	7.95
8417	6.95
8844	25.00
8874	215.00
8950	10.50
9001	1.50
18042	10.50
18045	10.00
18046	11.50

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SPACE THE FINAL FRONTIER

BY BRIAN KENDAL G3GDU

AVIATION ELECTRONICS

Part Nine

Although civil aviation is one of the most highly developed and rapidly expanding industries in the world, surprisingly, space technology has, so far, made remarkably little impact.

Three systems are being used or developed, two of which are shared with other users. They are: COSPAS-SARSAT, an international search and rescue system; Navstar, an American global positioning system, and Skyphone, an air-to-ground telephone system for passengers.

COSPAS-SARSAT

It has long been believed that if the doppler shift on a signal relayed by a satellite moving in an accurately known orbit is measured, then the position of the transmitting station can be deduced to a reasonable degree of accuracy.

This concept was proved by Canadian scientists in 1975 using an early OSCAR satellite. As a result, an international programme was set up culminating in 1980 with the launch by the Soviet Union of COSPAS-1, the first satellite dedicated to search and rescue. This carried a basic transponder of which the input frequency was 121.5MHz, the VHF emergency frequency. The following year COSPAS 2 was launched, followed by SARSAT by the United States which was carried on the weather satellite NOAA-E.

The equipment carried by both Soviet and United States satellites is basically similar, except that the SARSAT also carries a transponder for 243MHz, the UHF distress frequency.

In simplest terms, the principle of the COSPAS-SARSAT system is that a series of satellites in low polar orbit listens for distress signals. When received, these are relayed to a Local User Terminal (LUT) where, using a measurement of doppler shift on the frequency of transmission and a precise knowledge of the satellite orbit, the origin of the distress signal can be derived. This information is passed to the Mission Coordination Centre (MCC), which in turn alerts the appropriate Rescue Coordination Centre (RCC), which instigates the search and rescue operation in accordance with normal practice.

The system has much to commend it, not the least because within the first eighteen months of operation it provided data on 85 distress incidents from which 214 persons were rescued.

The accuracy, too, has been remarkable, for working on a database of nearly 200 cases where an Emergency Locator Transmitter (ELT) was located, the mean radial error was less than nine miles.

Despite this success, the system has severe limitations.

Currently, the satellites are operating in conjunction with a generation of ELTs and EPIRBs (Emergency Portable Indicating Beacons) which were never designed for operation with satellites. Many of these operate with very low power (50 – 100 milliwatts), which provides very poor signal strength at satellite altitudes.

Secondly, the present system operates in real time, therefore requiring that both the emergency beacon and the LUT be visible to the satellite at the same time. This severely limits the geographical area over which service can be provided. As a result of this there are large areas of the world, particularly over the Pacific Ocean, where no service is provided.

In order to overcome these difficulties and further broaden the capabilities of the system, an additional frequency (406MHz) is being introduced.

The new generation of emergency beacons is designed to work with the satellites. In addition to the distress signal as radiated by the current generation, this equipment will also be designed to radiate a unique identification and digitally encoded message giving details of the distress situation and position in latitude and longitude.

The new satellites will be capable of recording any distress signals received and retransmitting when interrogated by a ground station. Thus the limitation that both distress beacons and LUT must be in range of a satellite in order to obtain a 'fix', no longer applies and world-wide coverage will at last be possible.

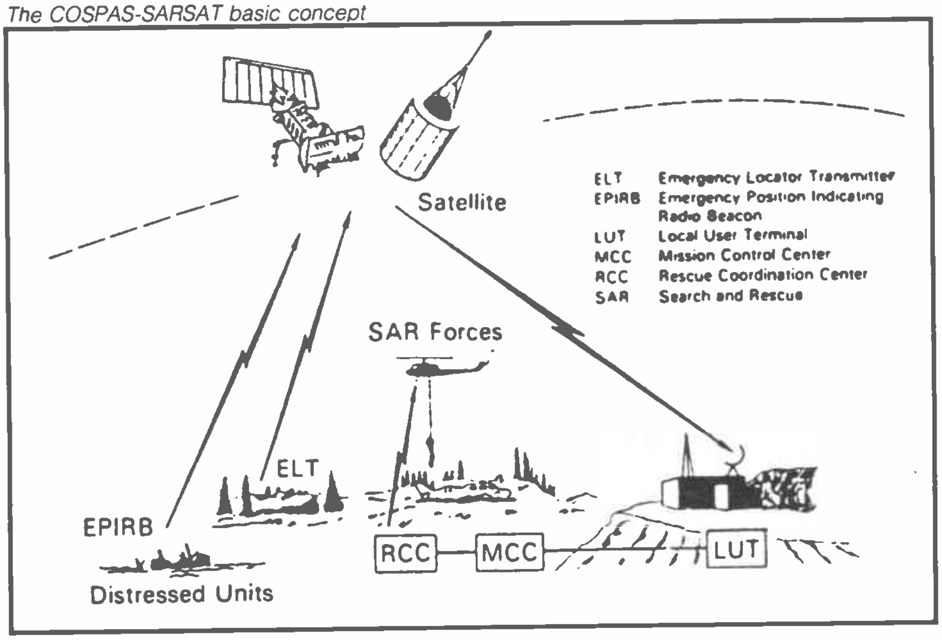
Furthermore, due to the higher frequency of transmission, doppler shifts will be greater and the position of the distress site will be determined to a far higher degree of accuracy.

Navstar

There has always been a requirement for a world-wide navigational aid with an accuracy of a few metres. With the introduction of the Navstar Global Positioning System (GPS) it would appear that this ideal has been very closely approached.

The development of the Navstar GPS began in 1973 when the USAF, Army, Marine Corps, Navy and Defence Mapping Agency combined their technical resources to develop an accurate space based navigational system.

The COSPAS-SARSAT basic concept



As with many systems, the basic principle is relatively simple: namely that a number of satellites in orbit each radiates a series of precisely timed radio signals. The user notes the time at which the signals are received and from the delay of each due to transit time and knowledge of the position of the satellite at the moment of transmission, calculates his distance from each and thus his position.

Simple though this basic concept may be, in practice difficulties abound and as a solution, an aid has been developed which is capable of resolving the user's position on earth to better than 100 metres for civilian equipment and approaching an order better for military/survey purposes.

The spacecraft

The constellation of satellites will ultimately comprise 18 in six separate orbital planes plus an additional three for operational back-up.

For navigational purposes, each satellite transmits signals on two frequencies in L band: 1575.42 and 1227.6MHz, these being known as the L1 and L2 signals respectively. Two modulations are used: precise (P), intended for military/survey applications, and Coarse/Acquisition (C/A) for general use. The L1 signal will carry both modulations but L2 will carry either P or C/A but not both.

Four further frequencies are carried on each satellite, these being: two S band channels for refreshing the pre-calculated spacecraft position memories and correcting the satellite clock from ground stations, and a further L band and a UHF channel for the spacecraft's second payload. The signals are radiated from a shaped beam aerial which provides a power level of at least −66dBW to users.

The navigational information is simultaneously provided on two frequencies in order that any inaccuracies due to refraction effects in the ionosphere may be eliminated, these being approximately inversely proportional to the square of the frequency.

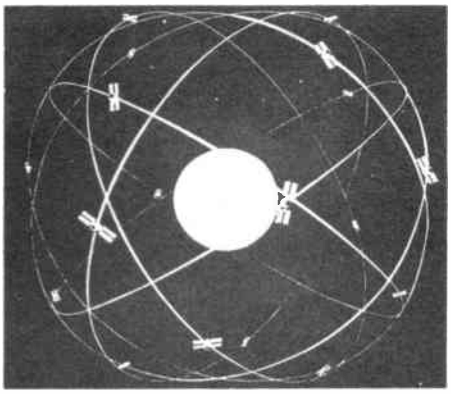
Each Navstar satellite has a weight of 850kg (1862lb). It orbits the earth at a height of 10,898 nautical miles with a period of 12 hours in one of six orbital planes each inclined at 55° to the equator. It is expected that each satellite will have an operational life of about seven and a half years.

The information channels

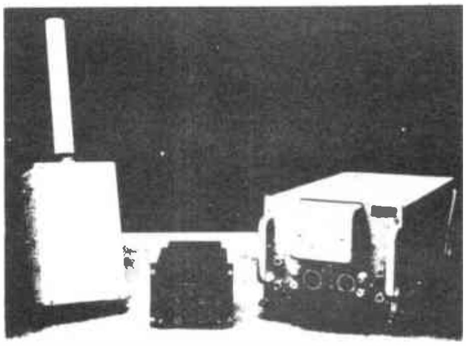
The C/A signal is a pseudo-random but predetermined digital signal, unique to each satellite, of 1023 bits clocked at a rate of 1.023Mbps and repeats continuously. Each sequence, therefore, occupies one millisecond.

In addition to the pseudo-random code, the satellite also radiates a data bit stream at 50bps. This provides information on the status of the space vehicle; the time synchronisation information for transfer from the C/A to the P code; the parameters for computing the clock correction, the ephemeris of the space vehicle and the corrections for delays in the propagation of the signal through the atmosphere. In addition, it contains almanac information which defines the ephemerides and the status of all the other space vehicles, this being required for use in signal acquisitions. Provision is also made for the inclusion of special messages.

The navigation message is formed in five subframes each six seconds in length. These combine to make a complete data frame of 1500 bits occupying 30 seconds.



An artist's impression showing a constellation of 18 Navstar satellites and their orbital planes of trajectory



Navstar receiving equipment. The aerial (left) is designed for low speed aircraft and helicopters. This equipment is manufactured by Canadian Marconi

Repeat Interval of Frequency

P-code	
Reset	7 days
Frequency	10.23MHz
C/A code	
Epoch	1 millisecond
Frequency	1.023MHz
L1 RF frequency	154x10.23=1575.42MHz
L2 RF frequency	120x10.23=1227.6MHz

The precision (or P) code is also pseudo-random, but the data rate is 10 times higher at 10.23Mbps but as this is intended for military and survey purposes only, it will not be discussed further here.

The precision timing of the transmissions of each satellite is controlled by an on-board atomic clock of 10.23MHz nominal frequency whose accuracy is such that it would gain or lose only one second every 36,000 years. Even this, however, is not sufficiently accurate. The space vehicle timing is, therefore, regularly compared with caesium clocks maintained by the Master Control Station (MCS). Corrections are then transmitted to the satellite from where they are relayed to users via the 50bps data stream.

The pseudo-random codes, which are synchronised to the space vehicle time, are maintained within 976 microseconds of the GPS system time in order to preclude secondary control problems, such as almanac word length limitation, which would otherwise arise.

All frequencies in the satellite are derived from, and synchronised to, integrals of the 10.23MHz frequency standard. See table below left.

Resolving the signal

On the face of it, the determination of the distance of the spacecraft would be simple – merely compare the time of arrival of the signal with the user equipment internal clock and, knowing the speed of transmission of electromagnetic radiation, derive the distance between user and spacecraft. Repeat the process with two or three other satellites and from these results derive the user's position.

Unfortunately, life is not quite so simple, so techniques have to be developed to allow for the real world situation.

The first task of the user's receiver is to synchronise with the received satellite transmission. This is achieved by generating an internal pseudo-random code, identical to that radiated by the satellite in use which is then compared with the received signal. When correlation is obtained, the time of receipt of the signal can then be determined.

This, however, could be subject to considerable ambiguity, for the C/A code epoch is just one millisecond. As the speed of electromagnetic radiation is 186,000 miles per second, this corresponds to a distance of 186 miles. However, the satellite is positioned in a high orbit and in general the spacecraft to user distance will be in excess of 11,000 miles – a transit time in the order of 60 milliseconds. This ambiguity is resolved by inverting the phase of the stream at 50Hz, ie every 20 milliseconds. Some ambiguity will still remain, but it would be hoped that the user has some idea of his position – certainly within the 3,000 miles which this represents!

With the C/A signal synchronised within the receiver and the ambiguity resolved, the 1.023MHz pseudo-random signal may be used as markers to interpolate between the 1 millisecond (186 mile) repetitions, ie to approximately 960ft. Further interpolation within the set will provide even further accuracy. If the distance to two other satellites is then determined, the user's position may then be derived.

Such accuracy of distance determination is, however, dependent on very accurate synchronisation between the spacecraft and user equipment clocks, for every nanosecond discrepancy will result in a 1ft error.

Unfortunately, the cost of inclusion of a clock of such accuracy within the user equipment would make the installation of GPS equipment totally uneconomic. Another means of deriving the GPS time had, therefore, to be sought and this was achieved by the use of a fourth satellite for obtaining a positional fix.

In understanding this technique, let us first consider that the user is at a position described by the co-ordinates Ux, Uy, Uz, and the satellite is at range R1 at position co-ordinates: X1, Y1, Z1. The clock bias (ie the discrepancy between user clock and GPS time) = CB, then: (X1−Ux) + (Y1−Uy) + (Z1−Uz) = (R1−CB)...(1). And for the second, third and fourth satellites: (X2−Ux) + (Y2−Uy) + (Z2−Uz) = (R2−CB)...(2), (X3−Ux) + (Y3−Uy) + (Z3−Uz) = (R3−CB)...(3), (X4−Ux) + (Y4−Uy) + (Z4−Uz) = (R4−CB)...(4).

In these equations, the values for X1, Y1, Z1, X2, Y2, Z2, X3, Y3, Z3 and X4, Y4, Z4 are provided by the satellites and R1, R2, R3 and R4 are measured times. This leaves only Ux, Uy, Uz (the user's position) and CB (the clock bias) unknown. With four equations, solutions for all unknowns are possible, this being achieved within the receiver using iterative techniques.

In order to maintain the full possible accuracy of the Navstar GPS system, the satellites are monitored and updated at least once a day by the Master Control Station. These updates include clock correction factors, satellite ephemeris constants (orbital elements) and information on the current status of the earth's ionosphere.

Corrections are also made for relativity effects in accordance with Einstein's special and general theories of relativity. Due to this, for example, allowance is made that the user equipment is affected by stronger gravity than is experienced by that on the satellite. For this, the satellite clock frequency, nominally 10.23MHz, is offset to 10.2299999945MHz.

Experience with the Navstar GPS system indicates that, despite the constellation of satellites being incomplete, the accuracy of the system is higher than originally invisaged, reaching about 15 metres using the C/A code and about 6 metres with the P code.

Skyphone

For several years passengers on internal flights within the United States have been able to make telephone calls to subscribers within that country. The system, however, uses VHF communication between the aircraft and the ground station and is subject to problems of limited range etc.

In contrast, Europe approached the problem from another angle in more senses than one – by using an Inmarsat satellite.

Europe's first public satellite telephone call from an aircraft was made on 2nd June this year from a Jetstream aircraft (G-RAVL) belonging to Racal Avionics.

The tests from the Racal aircraft will be followed in late 1988 by a trial commercial service for passengers travelling on two British Airways Boeing 747 aircraft operating the transatlantic and African routes, and eventually by a full commercial direct dial service available to all airlines by mid-1989.

Using the Inmarsat satellite network, this will offer passengers a direct dial telephone service to 185 countries world-wide as well as facilities for the transmission of aircraft operational telephone and data traffic.

The small size of Racal's big blade Skyphone antenna in relation to a 747 aircraft is demonstrated below. The inset shows a close up of the antenna design. (Photo courtesy of Racal Avionics)

The Racal Avionics Jetstream aircraft G-RAVL which is currently being used in the Skyphone trials

The telephone transmission uses a digital coding system operating at 9.6kbit/s which, with an added signalling channel and error correction gives a total signalling rate of 21kbit/s.

This is radiated from the aircraft to the satellite on a frequency of 1.6GHz using a power of 70 watts to a 10dBic gain blade aerial. This array is electronically steerable over 40 degrees in elevation and 80 degrees in azimuth.

The received signal at 1.5GHz is first passed to a Low Noise Amplifier (LNA) which, even allowing for losses in the pre-LNA filter, exhibits a noise figure of better than 2.5dB. This amplifies the signal sufficiently to permit long cable runs to the aircraft equipment racks where the remainder of the equipment is housed.

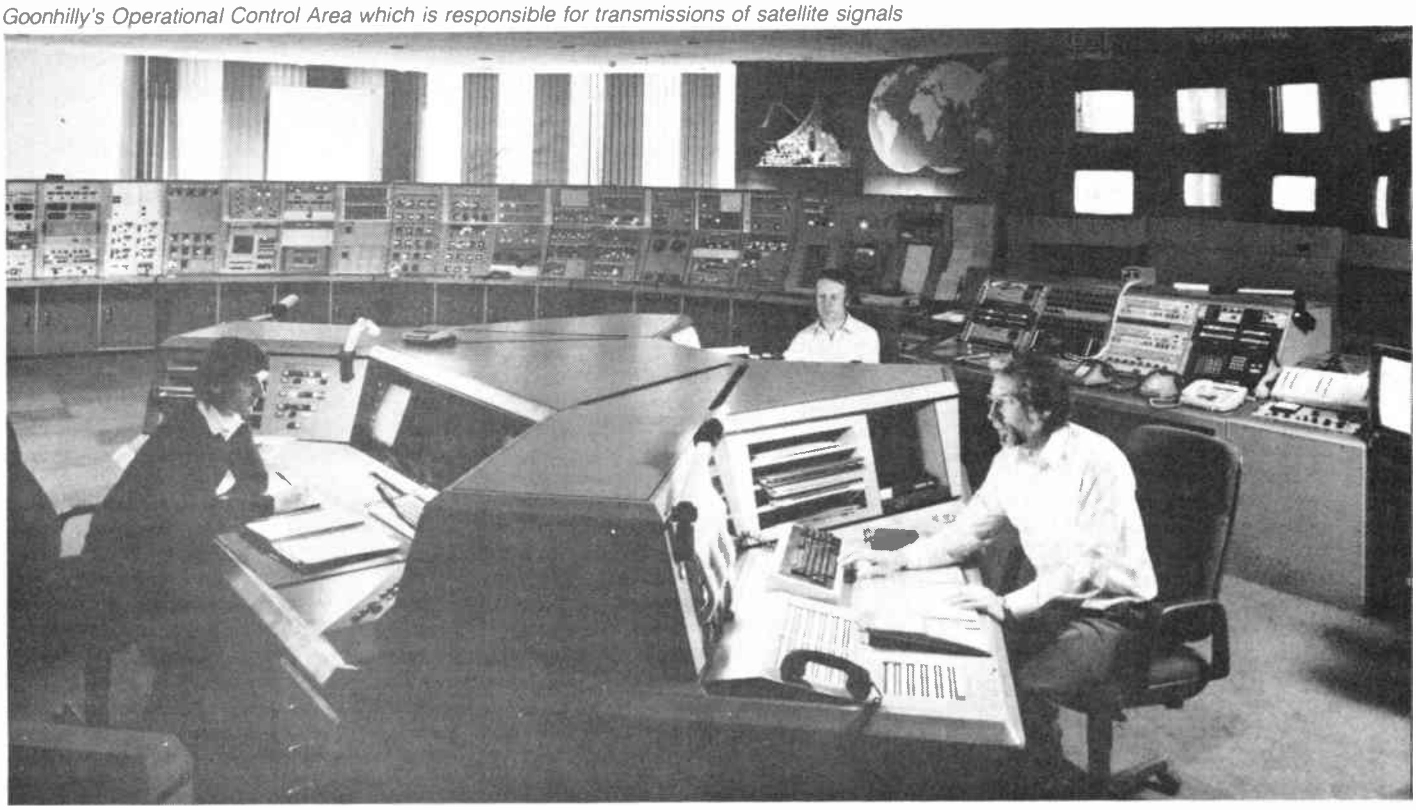
The signal from the aircraft is relayed by the Inmarsat Atlantic Ocean Region satellite (currently Marecs B at 26° west) on a frequency of 4GHz to the British Telecom's Satellite Earth Station at Goonhilly Down. Here the trial transmissions were received on Aerial No 7. This is a 13 metre diameter dish which had formerly been used for the transmission of leased television services. Transmissions in the reverse direction, from ground to satellite, used a frequency of 6GHz.

For the present, the only service available will be for in-flight passengers to dial outgoing calls. The problem for subscribers wishing to call in-flight passengers is, however, being investigated. Initial thoughts are that messages such as 'JIM SMITH RING 44 1 xxx xxxxx' could be passed by data transmission systems. Whether this or some other system is adopted still remains to be seen.

In this series of articles, we have taken a brief look into the world of aviation electronics. From the simplest non-directional beacon to the complexities of the Navstar Global Positioning System, each piece has a vital role to play in ensuring the safety of aircraft in flight throughout the world.

When, therefore, you next take the charter flight for your package holiday on the Costa Bundle, or you take your first-class seat for a business trip to the other side of the world, consider for just a moment the organisation, equipment and skills which have combined to make flight the safest means of transport in the world.

Goonhilly's Operational Control Area which is responsible for transmissions of satellite signals



DX-TV RECEPTION REPORTS

Compiled by Keith Hamer and Garry Smith

July seemed relatively peaceful after the hectic excitement of the previous month. Nevertheless, there were some good points and long-distance reception conditions were on the whole, fair. There were a few days worth noting with high mufs present, enabling Band II TV and FM stations to be received. On the 10th, a high muf allowed Yugoslavia and Rumania to be worked by amateurs on 144MHz for over two and a half hours during the afternoon. Such conditions could have provided TV signals in Band III but sadly there were no reports.

Tropospheric DX during the third week of the month provided a number of rare signals, including Austria in Band III.

Tropospheric highlights

Tropospheric DX on the 19th brought in Austria on channel E5 for Kevin Jackson during an intense opening to Switzerland. La Dole on E34 lasted some three hours and colour was obtained at times. On the same morning, Chris Howles saw many Canal Plus stations in Band III and on E9 an FuBK which seemed to have a '+PTT' identification. This was most probably the '+PTT SSR1' FuBK from the low-power (less than 5kW ERP) La-Chaux-de-Fonds transmitter on E9. According to Kevin Jackson's log for that particular morning, the highlight of the 19th was the reception of Pfänder, the Austrian 1st network transmitter on channel E5. This particular outlet is located close to the Swiss border.

DX-TV log for July

This month, we are featuring Kevin Jackson's DX log which details conditions at his location in Leeds. Reception consisted of programmes unless stated otherwise.

06/07/88: TVE-1 (Spain) channels E2 and E3; TVE-2 E2; RTP (Portugal) E2 and E3 – all received during the afternoon.

08/07/88: Canal Plus (France) on channel L3 at 1512; TVE E3 and E4; RAI-1 (Italy) IA at 1546; JRT (Yugoslavia) E4; TVR (Rumania) R2 showing colour bars followed by the 'TVR BUCURESTI' FuBK test pattern at 1749; MTV-1 (Hungary) R1 and R2 at 2335.

09/07/88: Canal Plus L4 at 1649; TVE-1 E3 and E4; RAI IA at 1650; RAI IB at 1847; TELEMARKET (a private Italian station) just below E2 at 1859; SVT-1 (Sweden) E2 and E4 at 2325.

10/07/88: RAI-1 IA at 0900; MTV-1 R1 and R2; TELEMARKET just below E2 at 1019; RUV (Iceland) E4 with the 'RUV ISLAND' PM5544 test pattern at 1058; JRT E3; ARD-1 (West Germany) E2; CST (Czechoslovakia) R1 caption at 1102 and TVR R2 at 1953.

11/07/88: TVR R2 colour bars at 1656 – also the station opening logo at 1956; RAI-1 IA and IB at 1717.

12/07/88: RAI IA 'RAI-1' PM5544 at 0826; JRT E4; ERT (Greece) E3 with the 'EPT' PM5534 at 0840; RAI IB 'RAI' caption at 0901; Canal Plus L3; TELEMARKET just below E2 at 0956; TSS (Russia) R1 UEIT test pattern at 1222; TSS R2 at 1240; JRT E3 'Beograd' caption at 1250; SVT-1 E4 'KANAL 1 SVERIGE' PM5534 at 1310; ORF (Austria) E2a and E3 showing the 'ORF FS1' PM5544 at 1340.

18/07/88: Tropospheric lift with TDF (France) Antenne 2 L34 and L39; Canal

PHOTO FILE ● PHOTO FILE ● PHOTO

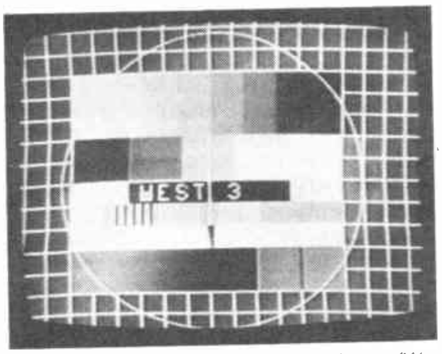


Fig 1: Westdeutsches Fernsehen (West Germany) with new identification for the third network

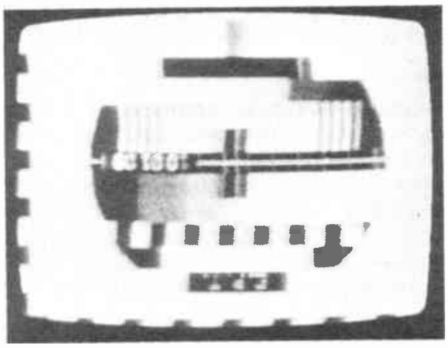


Fig 2: Greek PM5534 test card on channel E3 displaying a video fault

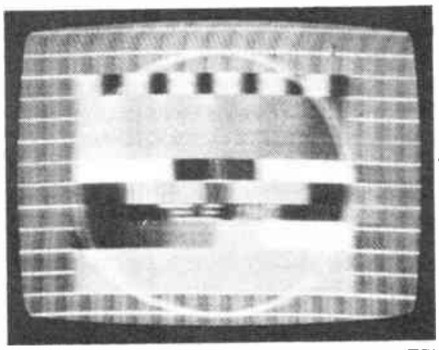


Fig 3: Italian private station test card with 'TELE UNO' identification received on channel IA

Fig 4: Band III Sporadic-E DX from Algeria on channel E7 from the Constantine transmitter

Fig 5: Algerian newsreader received on channel E5 from the M Cid transmitter

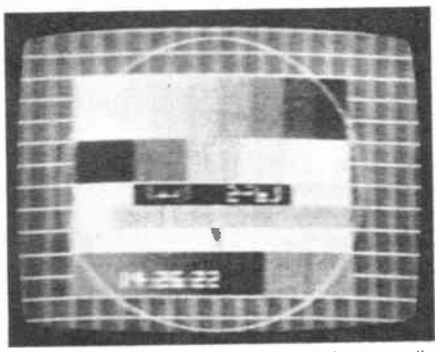


Fig 6: Libyan test card received via sporadic-E from the 20kW outlet at Tripoli on channel E6

Plus L5, L6 (vertical polarisation), L7, L8, L9 and L10; Netherlands NED-3 E35; Belgium BRT-1 E10 and E43; RTBF-1 E8; Luxembourg RTL+ on channel E7.

19/07/88: TDF (France) tf1 L27, L42, L43 and L63; TDF Antenne 2 L21, L34, L39, L46, L48, L53 and L57; TDF FR-3 L26, L40, L45, L50 and L60; Canal Plus L5, L6, L7, L8, L9, (vertical polarisation) and L10; NED-1 (Netherlands) E6; NED-3 E30, E34 and E35; RTBF-2 (Belgium-French language network) E45 (500W); BRT-1 (Belgium-Flemish language network) E10 and E43; West Germany SWF-1 E8; SWF-3 E40; RTL+ (Luxembourg) E7; Switzerland TSI-1 (Italian-language network) E34 (two transmissions seen) and E35 all showing the '+PTT TSI1' FuBK test pattern; Switzerland SRG-1 (German-language network) E6, E7 and E31; SSR-1 (French-language network) E9 and E10; ORF-1 (Austria) E5 – all via enhanced tropospheric conditions, TSS R1 UEIT test card with 'LATVIJAS TV' identification at 1219 via SpE.

13/07/88: Late evening Sporadic-E opening with RAI-1 on channel IA.

14/07/88: Mid-afternoon opening to Spain on E2 and E3 accompanied by RAI-1 IA.

20/07/88: TSS R1 with UEIT test pattern at 0802 – a similar pattern was noted on R2 with '1988' identification at the top. Another Russian test card, the monoscopic '0249' was present on R1 at 0902; MTV-1 R1 and R2 showing colour bars at 0828; TVE-1 E3 and E4; RAI-1 IA and IB at 1809.

21/07/88: RAI IA 'RAI-1' PM5544 at 0812; CST R2 with 'SR1 TV BRATISLAVA' PM5544 at 0813; MTV-1 R1 and R2; RAI-1 IA teletext pages at 0842; JRT E3 and E4 at 0900; ARD-1 E2; TSS R1 colour bars at 0903, also TSS 'UT 0167' UEIT test pattern at times; Canal Plus L2, L3 and L4; TVE-1 E2, E3 and E4; CST R1 with 'RS-KH' EZO test card at 1149; TVR R2 at 1902.

26/07/88: YLE-1 (Finland) E3 and E4 with the 'YLE TV1' FuBK at 0959; NRK (Norway) E4 'HADSEL' PM5534; SVT-1 E2 'KANAL 1 SVERIGE' PM5534 at 1142.

Italian DX

The reception of low-power Italian transmitters, both state and privately owned, was very much a feature of July. The 'RAI-1' PM5544 from the 40W relay for Campione d'Italia (Swiss Ticino) emerged from the noise shortly after 0800 on the 24th, while earlier in the month, RAI-1 signals were resolved on channel IC in Band II. The latter transmitter is at Torino and for years there have been rumours about its closure. Further reception from this transmitter may have occurred at 1910 on the 21st, when David Glenday of Arbroath logged a cartoon.

The FM band was extremely active with Italian stations around that time. The private station TELEMARKET was identified by Kevin Jackson of Leeds on July 9th, 10th and 12th just below channel E2, while the authors managed to see it on the 14th. On the 10th at 1505, Bob Brooks of South Wirral obtained clear reception of the TELE UNO test card on channel IA.

On July 25th, a chequerboard test pattern appeared on the same channel but Bob failed to identify it. It sounds very much like NCT (Nord Centre Television – or is it North Channel Television?) which has used this test pattern in the past. Incidentally, NCT was one of the first private stations to use Band I frequencies during deregulation in the late seventies.

Reception reports

One of Bob Brooks' best days was the 10th, with signals from central Europe lasting for most of the day. The West German FuBK with the 'GRÜNTEN' inscription emerged on channel E2 at 0820 followed by a Russian clock caption on R1 at 0830. The 'ITN NEWS' was being shown over the Spanish 1st network (TVE-1) around mid-morning, while on another channel 'Hello Vienna', an English-language educational programme, was later identified as Austria. Signals from the north-west were also logged, when the Icelandic PM5544 with 'RUV ISLAND' identification came through at 1147. From the south-east, two Yugoslavian networks were present on channel E3. The Beograd network was showing a concert while the Ljubljana region showed the 'JRT RTV-LJNA' PM5544 test pattern. The highlight of the day was TELE UNO on test card at 1505 and Rumania with colour bars, followed by the 'TVR BUCURESTI' FuBK and the opening sequence on R3.

The 20th brought in Scandinavian, Central European and Spanish DX for David Glenday of Arbroath. At 1000 the Norwegian PM5534 test pattern from Hemnes and Steigen was resolved on channels E2 and E3. The Russian UEIT test pattern was present on OIRT channels R1 and R2, but not for long. Hungary won the battle on R1 with sample teletext pages headed 'Kepujsag' followed by the MTV clock.

In Band II a film was monitored on R3 from Poland, although another sound channel accompanied it from a co-channel transmission. At 1036 the station closed with the 'TP' clock followed by the PM5544 with a dark background. Italian and Spanish programmes were evident towards the end of the morning. Switzerland occupied channel E2 for much of the afternoon with the '+PTT SRG1' FuBK test pattern. David remarked that the test pattern was still being screened at 1755 Swiss time!

Oil rig TV

During the period of enhanced tropospheric reception, Ian Menzies noted TELE 5 on E48 and SAT-1 on E46 from the new local satellite relay transmitters in Hamburg, West Germany. Another rewarding example of tropospheric DX reception was EKOFISK TV CH1 and CH2. These are transmissions from a North Sea oil platform; CH1 relays programmes on E50 while CH2 (channel E49 approx) shows DBS feeds and videos – in Norwegian.

Arabic mysteries

Arabic programmes were successfully resolved in Band I by two enthusiasts. On the 3rd, Simon Hamer of New Radnor, saw one on channel E3. Ten days later the Belgian DXer, Marc Vissers, heard an Arabic sports commentary on channel E4. Vince Richardson of Conwy, has also noticed programmes with Arabic subtitles this season but their origin remains a mystery.

Sunburnt test card

On July 12th, the Greek E3 transmitter was received during the morning and again after lunch with the PM5534 test pattern. The second sighting clearly showed that a video fault was present at the transmitting end. The same fault was present earlier in the season. The background looked bleached – it had probably suffered from too much sun!

Overseas reports

Walter Gouder of Malta, has sent in an excellent log with all European countries received, except Iceland. Jordan and Syria regularly feature in the log, which no doubt makes most of us in the UK feel a little envious. Needless to say, settled weather conditions in the Mediterranean creates tropospheric enhancement for months at a time, so the reception from north African countries on a daily basis, is available.

The reception of Albanian transmissions on channels IC and R7 is also possible at times and so is Greece at Band III and UHF. The 1st network shows only the abbreviation 'EPT' at the top of the PM5534 test pattern but on channels E22, E43, E50 and E57 additional identification, 'ET 2', appears at the bottom, which presumably indicates the 2nd network. Towards the end of May, the old Indian Head monoscope test card was in use on channels E42 and E50! Another strange monochrome test card (the Philips PM5540) was seen on June 29th and 30th from the east on channel E8. Walter asks whether this could have been Israel?

From further afield, Lt Col Rana Roy has written about his TV DXing experiences in India this summer. As in Europe, June tended to be more productive in the way of exotic signals and the actual number of openings. Russia, China and Dubai are received frequently in Band I and, less frequently, Iran.

Rana comments that Dubai is radiating sample teletext pages in Arabic during test periods rather than its unique square-version PM5544 test card.

On one occasion, colour bars were resolved on channel E4 with a circle superimposed. This he could not identify but apparently Mauritius was using a similar test pattern a couple of years ago. Their main transmitter operates on this channel. It is located at Forest Side and has an ERP of 15kW.

June has been the best month so far for Rana and a couple of extracts from his log are featured below. All the indicated times are local.

07/06/88:
Ch E4, weak signal from Pakistan TV (Peshawer TV). Signals improved at 0815 – Karachi TV on E4 was also coming up. At 1500, TSS was noted on R2 and R3 but signals faded at 1530. At 1710, channel E2 teletext in Arabic from Dubai, then a clock at 1728 showing '1558'. A programme schedule was followed by prayers and a cartoon in Arabic. There was a Tom and Jerry cartoon at 1805. Pictures faded away at 1820.

20/06/88:
At 1445, weak signals were received from China on R1 which looked like the news. This finished at 1500. A programme for children followed.

24/06/88:
On Ch E2 at 0725, weak signals were received in Arabic script and sound. At 0730, teaching of the Koran (thought to be Iran). TSS R1 at 1640 with a feature film. On R1 at 1745, a Chinese station was heard with the news. Signals faded at 1915.

French scene

Bertrand Prince has logged virtually every European country this season. He has also explained how the Canal Plus pay-as-you-view TV service operates, something we will be experiencing in the UK as soon as the Government gets its own way.

Canal Plus uses SECAM System L (Positive video modulation and AM sound). Most transmissions take place in Bands I and III using re-engineered channels, which were previously occupied by the 819-line transmissions until the early eighties.

Canal Plus transmissions are mainly scrambled or encrypted, therefore, a decoder (DISCRET 1) is required in order to view. Canal Plus is a private organisation and will supply decoders only to viewers in France. This means that neighbouring countries such as Belgium, West Germany and Switzerland where signals are present, viewers are not allowed to subscribe to the Canal Plus network.

In France, the monthly subscription amounts to 140 French Francs (almost £14) and a deposit has to be paid for the initial installation of the decoder unit. A key or code number is required for the decoder to function, which is changed on a monthly basis. Provided the viewer has paid the latest subscription, Canal Plus sends through the mail a new code number. Since each decoder requires its own individual number, it is useless asking the next-door neighbour for theirs when the subscription expires. It's a simple case of no money, no viewing!

Customer resistance to this extortionate monthly subscription rate has meant that many pirate decoders have been produced to satisfy public demand. Since Canal Plus started in 1984, the police have made searches in many homes belonging to electronic technicians. This led to several court cases where many pirate decoder designers have been arrested.

UK Band III services

It is interesting to note how Band III frequencies are being used, now that the Government has been persuaded not to allow its use for future terrestrial TV broadcasting in the UK.

The 'new' users are having to share it with such things as radio microphones and pirate FM radio links. The latter are a particular annoyance in some cities, especially for the DX enthusiast. Fortunately, in the Derby and Nottingham area such a pirate FM link lies between channels E8 and E9 amidst the legal users, so it causes no problems at the moment. Strangely, the link is stronger than the pirate broadcast at the top end of the FM band!

Puzzle

Mark Dent of Leeds, tells us that during a recent tropospheric lift to West Germany and surrounding countries, he noticed a weakish PM5544 test card with a very dark background, similar in appearance to the Polish one. The time was 0700 and the test card, on channel 30, appeared to have an identification in the lower black block. Identification is rarely used on the Polish test card (the 1st and 2nd network test cards are identical) and there are no high power TVP outlets on channel 30. Mark suspects that the test card may have originated from the Lopik transmitter of Nederland-3 during a special test transmission. This ties in with a report from Kevin Jackson who recalls seeing it on channel 42, which also carries the Nederland-3 broadcasts. There have been no further sightings of this test card.

New DX publication

An updated version of the popular 'DX-TV Data File' has just been published. The new edition includes an expanded section on European television services with very useful information about all the networks. A new feature of the Data File is a section showing the latest test cards and identification captions from around Europe. It also includes a transmitter map of Europe, a comprehensive list of all the main transmitters with ERPs, information about transmission standards and channel relationship charts for Bands I and II (TV).

DX-TV Data File (Edition 2) costs £5.95 (including UK and surface postage, world-wide) and is available from: HS Publications, 7 Epping Close, Derby DE3 4HR.

Service information

Finland: According to Finnish press reports, a discussion is on the way to open a YLE relay station at Tartu in Estonia! The relay will be fed via microlink since it is not possible, unlike in Tallinn, to receive YLE direct.

Sweden: An additional high power UHF transmitter using channel E44 has recently entered service at the Västeraas site in central Sweden for TV2. The exact power is not known at the moment but is thought to be 1000kW. The reason for the transmitter is because viewers were unable to receive the correct regional programme for their area. Now both the Oestnytt (E44) and Mittnytt (E31) regional programmes are available.

System M relays in France

We understand that two American 525-line relay transmitters are not operating in mainland France and Corsica. Channel A5 is in use which corresponds to the

New French transmitters now in service

LA CINQ (LA5)		METROPOLE TELEVISION 6 (M6)	
Maronne	L29	Riberac	L27
Draguignan	L32	Draguignan	L38
Fécamp	L34	Lisieux (St Desir)	L47
Lisieux (St Desir)	L34	Perigueux	L6
Dreux (Plateaux des Blattes)	L39		
Lillebonne	L44		
Rouen (Bois du Roule)	L45		
Les Sables-d' Olone	L61		

No information is available for either network regarding ERP or polarisation. The tf1 and LA5 networks now have twenty-four hour programme schedules which means the test card will no longer be shown.

New French transmitters currently in service

Russian R3 channel. The mainland outlet with 16W ERP (located at Le Plessis Robinson) relays CNN, whereas the Corsican transmitter broadcasts AFRTS programmes from the American Forces. This latter transmitter has an ERP of 110W and is located in the south of the island at Tower des Lauezzi.

Denmark: Hybrid-nettet, the programme supply company set up by the Danish telephone companies, can presently offer some sixteen TV and twenty-four radio channels which are distributed throughout Denmark by fibre-optic links. In the future, each household will be equipped with fibre-optics for computers, etc.

Via the Hybridnet service, the subscriber has the choice of sixteen TV and twenty-four radio channels at a cost of 39 DKr per month (about £3.40) or six TV and twenty-four radio channels for 14 DKr (approximately £1.20). Additional channels can be supplied for a small monthly supplement. This particular service is the only one to offer a choice of programmes from neighbouring countries. Some are received 'off-air' before distribution, while others are received via satellite. Multi-standard receivers are not required for the foreign broadcasts, since these are converted to System B/G PAL before distribution.

This month's Service Information was kindly supplied by: Gösta van der Linden (Rotterdam, Netherlands), Bertrand Prince (France), the Benelux DX Club (Netherlands), Michael Summers Larsen (Denmark) and Roger Bunney from the United Kingdom.

DX-TV Reception Reports

Station	Source	Transmission Times
1 DANMARKS RADIO	Denmark 1st network	
2 LOKAL TV	Denmark (Local TV)	
3 LOKAL TV	Denmark (Local TV)	
4 KANAL 1	Sweden 1st network	
5 TV2 SVERIGE	Sweden 2nd network	
6 ARD 1	West Germany 1st network	0900-0100
7 ZDF	West Germany 2nd network	1000-0100
8 NDR 3	West Germany 3rd network	1800-2335
9 SKY CHANNEL	Satellite TV	0730-0100
10 SUPER CHANNEL	Satellite TV	24-hour transmissions
11 TV5	Satellite TV	1635-2400
12 DDR 1	East Germany 1st network	1900-2400
13 DDR 2	East Germany 2nd network	1900-2400
14 BBC 1	UK via satellite	1500-2300
15 NRK	Norway	
16 TV2	Denmark	

Four of the radio channels are used for the distribution of stereo TV sound from SKY CHANNEL, SUPER CHANNEL, ARD-1 and ZDF

These TV channels are available via Hybridnet

Short Wave News for DX Listeners

by Frank A Baldwin All titles in UTC, **bold** figures indicate the frequency in kHz

Continuing our review of some of the African stations currently active on the 60m Tropical Band (**4750** to **5060**), having dealt with the more powerful transmitters in the previous issue, commencement is made here with those exhibiting powers of 50kW and less.

Stations situated in the formerly termed Dark Continent, are always of interest to the DXer and SWL alike. The distinctive musical styles, diverse languages and local vernaculars of the individual countries located within that continent, hold a fascination.

TRY THESE

FRCN (Federal Radio Corporation of Nigeria) Kaduna, Nigeria on **4770** often provides a good signal into the UK and is worth a listen. With a power of 50kW, it features programmes in the Home Service 2 in Hausa and English from sign-on at 0430 through to close at 2305 and has newscasts in English at 1600 and 1700. It is often heard here around 0630 and at 2100 with English transmissions.

On **4783** can be heard the signals emanating from Radiodiffusion Malienne, Bamako, Mali. At 50kW, it is on the air in French and vernaculars from 0600 (Sunday from 0700) to 0800 and from 1800 to 2400. There is an English programme on Sunday timed from 1830 to 1900. A parallel channel is that of **4835.**

Channel 4820 is the 50kW Radio Botswana, Gaborone. It radiates Home Service programmes in Setswana from 0400 to 1100 and from 1500 to 2100 with English newscasts at 0510 and 1610 Monday to Friday inclusive. From experience, the writer has found this is more easily logged if the receiver is aligned on channel just prior to 0400 when the tuning signal, consisting of faked farmyard sounds, is often audible. The frequency can prove difficult during our early evenings owing to co-channel USSR activity. After the 2100 close of Radio Botswana, it may also be possible to log the 10kW Angolan Emisora da Huila in Lubango, which operates in Portuguese and vernaculars from 0400 through to 2300.

A receiver adjustment to **4910.5** may result in hearing a transmission from ZBS (Zambia Broadcasting Services) Lusaka. At 50kW, Lusaka is on this frequency with the Home Service in vernaculars from 0355 to 0530 and from 1530 to 2105 (Saturday and Sunday until 2205) with news bulletins in English at 0500 and 1800.

AN INTERESTING CHANNEL

Settling on **4915** may prove interesting as two African transmitters are active here. The Voice of Kenya, Nairobi transmits the National Service in Swahili and was featured in the previous issue. Repeating the schedule details, it operates from 0200 (Sunday from 0230) to 0630 and from 1330 to 2010 (Saturday until 2110) with a power of 100kW. The 50kW GBC (Ghana Broadcasting Corporation) Accra is scheduled with GBC1 programmes in English and vernaculars from 0525 to 0905 (Saturday and Sunday until 2305) and from 1200 to 2305. To log Accra, then listen after the Voice of Kenya has closed.

UGANDA

This country may be heard on two frequencies in the 60m band. The first is **4976**, where Radio Uganda, Kampala transmits the Home Service in Swahili, English and vernaculars from 0300 (Saturday and Sunday from 0345) to 0600 and from 1300 (Saturday and Sunday from 1400) to 2100 with a power of 50kW. A newscast in English at 1900 has been frequently heard by the writer. It can also be heard around **5027**, although the frequency being slightly variable on occasions. On this latter channel, at 20kW from Soroti, Radio Uganda carries the National Programme in English, French, Swahili and vernaculars to the same schedule as Kampala. On some occasions, the English newscasts for example, the writer has noted Kampala and Soroti in parallel.

EARLY BIRDS

Not to catch the worm but to snare the signals of FRCN (Federal Radio Corporation of Nigeria) Lagos. Often beset during our evenings by co-channel interference from the USSR transmitter at Yerevan, an early morning listen on **4990** often proves to be the best time for hearing the signals from Nigeria; scheduled with Home Service 1 programmes from 0430 through to 2310 in English and vernaculars. An English programme has been heard from opening and a newscast at 2300.

LESSER POWERED

At 20kW, the rarely heard Radio Bertoua, Cameroon on **4750** is on the air, with the Home Service in French, English and vernaculars from 0430 to 0800 and from 1600 to 2215. Relays of the Yaounde news in English are at 0530, 1800 and 2100.

Sometimes heard here in the UK, when prevailing conditions for reception of the area are favourable, and when co-channel USSR activity is low, are the signals of Radiodiffusion TV de Djibouti in the Djibouti Republic. With a power of 20kW, Djibouti operates the National Service in Somali, Afar and Arabic from 0300 to 0800 (Friday from 0500 to 0900) and from 0900 to 1900. Djibouti has been heard by the writer when radiating a programme of monotonous sounding songs, complete with accompanying beats of a tam-tam and the wailing sound of a low-toned pipe instrument. The orchestral rendition of the National Anthem is notable in that an African drum predominates. The frequency is **4780.**

Radio Mozambique, Maputo on **4866** is on the air with programmes in Portuguese from 0255 to 0530 and from 1500 to 2205. At 25kW, Emissao Nacional is, in fact, frequency variable, sometimes being heard nearer **4865.** This one is often heard here in the United Kingdom.

Cotonou in Benin is another African station frequently logged by UK DXers. With a power of 30kW, Cotonou can be logged on **4870**, on which channel it carries the Home Service in French and vernaculars from 0500 (Saturday from 0545, Sunday from 0600) to 0800 (Saturday until 1100, Sunday through to 2300) and from 1300 to 2300. Occasionally, an English news bulletin is featured at 2000.

Heard here on many occasions throughout the past year have been the signals of Radio Naçional in Luanda, Angola. This 10kW transmitter, operating on **4953** (nominal **4950**), with programmes in Portuguese from 1800 to 0530.

Finally, in our African 60m band review, there is the 5kW Angolan station Emisora Regional da Cabinda, Cabinda which operates on, or around **4970.** On the air in Portuguese from 0455 to a 2100 variable sign-off, this one has been heard several times of late, both by European and UK based DXers. On occasions it has provided a better signal into the UK than Radio Naçional, Luanda on **4953.**

ON THE AIR

Try adusting your receiver to some of these frequencies and see whether you can log any of the transmissions reported here.

AFRICA

Egypt

Cairo on **12050** at 1532, Arabic music and a talk in the Arabic Home Service programme directed to Europe and North America from 0600 to 2250.

Ghana

Accra on **4915** at 2005, when presenting a news bulletin in English followed by the station identification. GBC1 operates in English and vernaculars from 0525 to 0905 (Saturday and Sunday to 2305) and from 1200 to 2305. The power is 50kW.

Nigeria

Lagos on **4990** at 0432, African drums, talking drum, the station identification, programme preview followed by a choral hymn, all in English. The Home Service in English and vernaculars is on this channel from 0430 to 2310 with a power of 50kW.

Senegal

Dakar on **4890** at 2357, announcements followed by the station identification in French and off, without the

National Anthem, at 0001. This 100kW transmitter is on the air carrying the National Service in vernaculars and French from 0600 (Sunday from 0700) to 0800 and from 1800 to 2400 (sometimes 0100).

Swaziland
TWR (Trans World Radio) Mpangela, on **4760** at 0323, choir with hymns, religious talk in Swahili programme timed from 0300 to 0330. The power is 25kW.

CENTRAL AMERICA

Costa Rica
Radio for Peace International, Santa Ana, on **7375** at 0235 when featuring a religious talk in English. Broadcasting in English and Spanish to Central America, this station is on the air from 0100 to 0400. The power is 2kW.

Honduras
Sani Radio, La Ceiba on **4755** at 0051, announcements then Spanish folk songs and music. The schedule is from 1200 to 1600 and from 2200 to 0200 in Spanish and vernaculars, the power being 10kW.

SOUTH AMERICA

Bolivia
Radio Nueva America, La Paz on **4796.2** at 0347, songs with guitar backing, announcements in Spanish and off, without the National Anthem, at 0403. At 1kW, the air time in Spanish is from 1000 to 1230 and from 2130 to 0400.

Brazil
Radio Ribeirao Preto on **3205** at 0351, Portuguese announcements followed by some local pops. The schedule is from 0700 to 0400 at 1kW.

Radio Difusora, Sena Madureira on **4117.6** at 0046, OM with a ballad in Portuguese heard on a good night for 90m band South American reception here in the UK. The schedule is from 1000 to 0200 (sometimes 0230). The power is 1kW.

Colombia
La Voz del Rio Arauca, Bogata on **4895** at 0326, OM with a talk in Spanish which included several mentions of Bogata followed by the station identification. New on the 60m band. The power and schedule is unknown.

Ecuador
La Voz de los Caras, Bahia de Caraquez on **4795.5** at 0327, a talk in Spanish followed by a sad, slow song then the station identification. This transmitter is on the air in Spanish from 1300 to 0500 (Sunday until 0200) with a power of 5kW.

Sistema Emisoras Progreso, Loja on **5060.4** at 0132, OM with some announcements and promotions followed by a ballad, all in Spanish. This one is on the air in Spanish and Quechua from 1000 to 0500 at 5kW.

Peru
Radio Andina, Huançayo on **4995.7** at 0238, OM with a talk in Quechua followed by a folk song. Radio Andina operates in Spanish and Quechua from 1000 to 0430, but on occasions to 0500, 0530 and as late as 0700, often being heard here around 0600. The power is 2kW.

Venezuela
Radio Tachira, San Cristobal on **4830** at 0356, OM with the full station identification, choral rendition of the National Anthem, the State Anthem and off at 0400. The schedule is from 0900 (Sunday from 1000) to 0400 (Sunday until 0300). The power is 10kW.

ASIA

China
Gansu PBS, Lanzhou on **4865** at 2142, Chinese music and announcements in the Home Service transmission timed from 2130 to 0130. Gansu is on the air in Chinese from 0330 to 0620 and from 0900 to 1600. The power is 50kW.

Iraq
Baghdad on **9770** at 2003, local and world news followed by the station identification during the English programme scheduled from 2000 to 2200 directed to Europe. The power is 250kW.

India
Madras on **4990** at 0035, songs and music in the local manner. This Tamil programme, in the Foreign Service of All India Radio, is broadcast from 0000 to 0045, the power being 50kW.

Pakistan
Azad Kashmir, Islamabad on **4790.5** at 1802, announcements, recitations from the Holy Koran, a short talk then a seemingly interminable choral anthem and off at 1808. This station radiates the Home Service in Urdu and Kashmiri from 1200 to 1415 and from 1430 to sign-off varying around 1805. The power is 100kW.

Sri Lanka
Colombo on **11800** at 1605, announcements, music and songs in the Hindi presentation to South Asia, timed from 1330 to 1630. The power is 100kW.

EUROPE

Iceland
Rikisutvarpid on **13770** at 1857, YL with a talk in Icelandic, then seven deep-toned chimes at 1900 in the Home Service programme directed to Europe from 1855 to 1930. The power is 10kW.

Italy
European Christian Radio, Ravenna on **9435** at 1400, interval signal followed by the station identification in English. The power is 1kW, this part of the schedule being unknown.

Spain
Madrid on **9630** at 0540, OM with a talk about tourists and their consumption of Spanish food. This English transmission for North America is timed from 0500 to 0600. The power is 350kW.

Vatican
Vatican City on **9645** at 0543, OM with the Latin programme to Europe, timed from 0520 to 0600, also heard in parallel on **9755**. The power is 100kW.

PACIFIC

Australia
VL8A Alice Springs on **2310** at 1950, OM announcements, pop music and songs in English. This Northern Territory Service was also just audible from the parallel VL8T Tennant Creek transmitter on **2325**, both at 50kW.

The schedule is from 0730 to 1430 and from 1930 (Saturday from 2000) to 2228 except Sunday when the CAAMA (Central Australian Aboriginal Association) programme in English and vernacular is carried by both transmitters from 1932.

CLANDESTINE

Voice of Democratic Kampuchea on **7385** at 1818, a newscast, songs and music and then a talk in Khmer with many mentions of Kampuchea, YL with some announcements and off, without an anthem, at 1856.

The transmitter location is China and thought to be at Kunming. The policy is that of support for the former Pol Pot regime. This broadcast is timed on a daily basis from 1800 to 1856.

NOW HEAR THIS

Radio Mamore, Guayaramerin, Bolivia on **4739.6** at 0140, folkloric songs in Spanish, together with music which is very typical of the locality. This 1kW transmitter operates in Spanish from 1045 to 1715 and from 2145 to 0100, which closing time can, and does, vary to as late as 0300 on occasions.

La Voz de Yopal, Yopal, Colombia on **5050** at 0018, announcements, folk songs then some promotions, all in Spanish. At 1kW, La Voz de Yopal is on the air from 1100 to 0100 in the Cara¸ol Network.

NOW LOG THESE

Emisora Regional do Moxico, Luena, Angola on **5192** at 1845, a talk in vernacular having mentions of Luanda. The schedule in Portuguese, vernaculars and Spanish is from 0500 to around 2300, the power being 5kW.

Onda Popular de Bambamarca, Peru on **5282** at 0442, folkloric songs and music, OM with announcements and the station identification in Spanish.

The schedule in Spanish and Quechua is from 2300 to a sign-off any time between 0400 and 0500 (Sunday from 2300 to around 0300). The power is 1kW.

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DATA FILE

Ray Marston looks at more solid-state power control devices and at a selection of practical circuits in the third part of his series on power control circuits

In the last two editions of Data File we have looked at basic electrical/electronic power control principles and at a variety of practical electro-mechanical and electronic power control devices such as switches, relays, transistors and FETs, CMOS bilateral switches, SCRs and Triacs. This month we take a closer look at SCRs and Triacs and associated devices, and then go on to look at some practical power-control circuits.

SCR/Triac 'rate-effect'

Last month we pointed out that the Triac can be regarded as a pair of SCRs wired in inverse parallel and that either type of device can be turned on by applying a suitable trigger signal to its gate terminal. In practice, internal capacitances inevitably exist between the anode and gate of the SCR, and between the MT1 terminal and gate of the Triac. If a sharply rising voltage is applied to the SCR anode or the Triac MT1 terminal, this internal capacitance can cause part of this voltage to break through to the gate and thus trigger the SCR/Triac on. This undesirable 'rate-effect' turn-on can be caused by supply line transients and sometimes occurs at the moment that supplies are switch-connected to the SCR/Triac.

The problem is particularly severe when driving inductive loads such as electric motors, in which load currents and voltages are out of phase.

Rate-effect problems can usually be overcome by wiring a simple R-C 'snubber' network between the anode and cathode of the SCR, or between MT1 and MT2 of the Triac. This limits the rate-of-rise of the voltage to a safe value, as shown (for example) in the Triac power switch circuit of *Figure 1,* where R1-C1 form the snubber network.

RFI suppression

Each time a resistance-driving ac-powered SCR or Triac is gated on, its load current transitions sharply rise (in a few microseconds) from zero to a value set by its load resistance and its instantaneous supply voltage value. This transition action inevitably generates a burst of radio frequency interference (RFI). This is at its least when the device is triggered close to the 0° and 180° 'zero crossing' points of the supply line waveform (where the switch-on currents are at their minimum), and is greatest when the device is triggered 90° after the start of each half-cycle (where the switch-on currents are at their greatest).

The RFI signal magnitude is also proportional to the length of the cable linking the SCR/Triac to its power load. Note that the RFI bursts repeat at double the supply line rate if the SCR/Triac is triggered in each supply line half-cycle. Consequently, RFI generation can be particularly annoying in simple lamp dimmer circuits. Fortunately, such problems can usually be eliminated by fitting the dimmer with a simple L-C RFI-suppression network, as shown in *Figure 2.* Here, the L-C filter is fitted close to the Triac, and greatly reduces the rate of rise of supply line transition currents, thus eliminating RFI.

Diacs and Quadracs

The SCR and Triac are the two best known members of a family of solid-state thyristor 'trigger' devices. Two other important members of this family are the Diac and the Quadrac.

Figure 3 shows the standard circuit symbol of the Diac, which is a 2-terminal bilateral trigger device that can be used with input voltages of either polarity. When connected across a voltage source via a current-limiting load resistor, it acts like a high impedance until the applied voltage rises to about 35 volts. At this point the Diac triggers and acts like a 30V zener diode, so 30 volts are developed across the Diac and the remaining 5 volts are developed across the load resistor. The Diac remains in this state until its forward current falls below a minimum holding value (this occurs when the supply voltage is reduced below the 30V 'zener' value), at which point the Diac turns off again.

The Diac is most often used as a trigger device in phase-triggered Triac variable

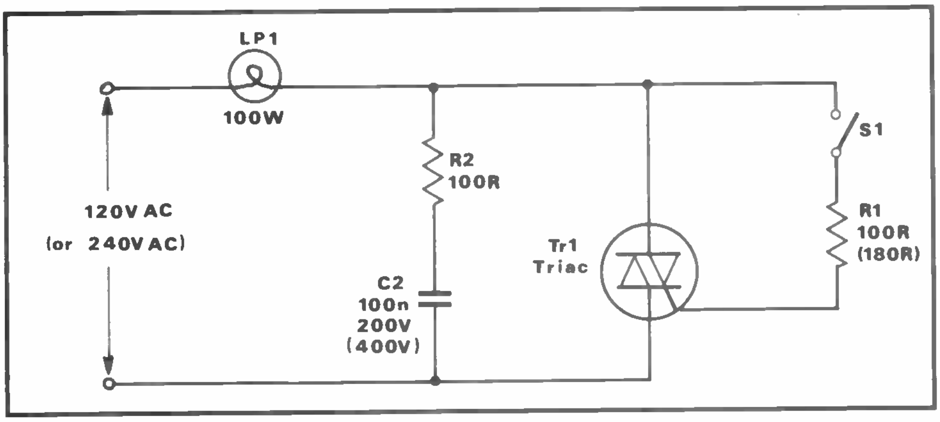


Fig 1: *Simple Triac power switch circuit with R2-C2 'Snubber' network to give 'rate effect' suppression*

Fig 2: *Basic lamp dimmer circuit with RFI suppression via C1-L1*

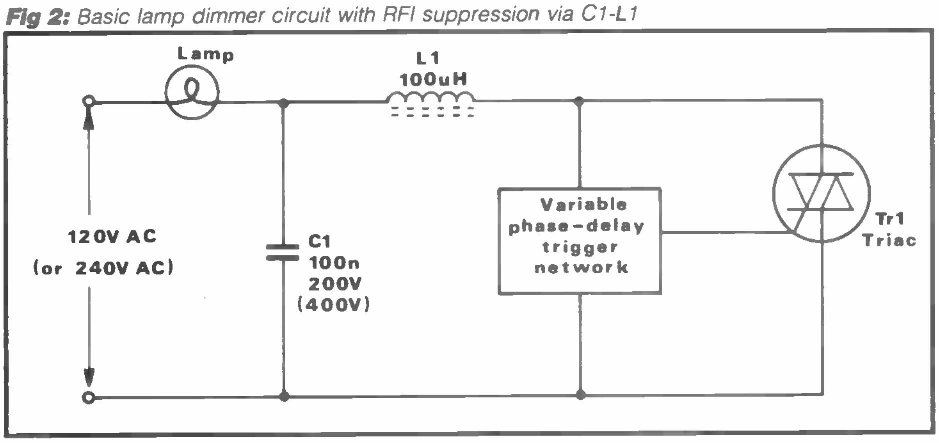
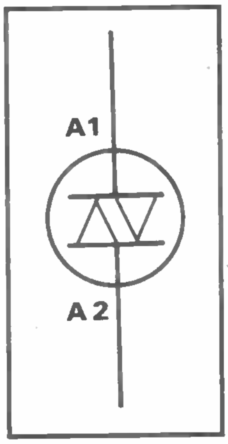


Fig 3: *Diac symbol*



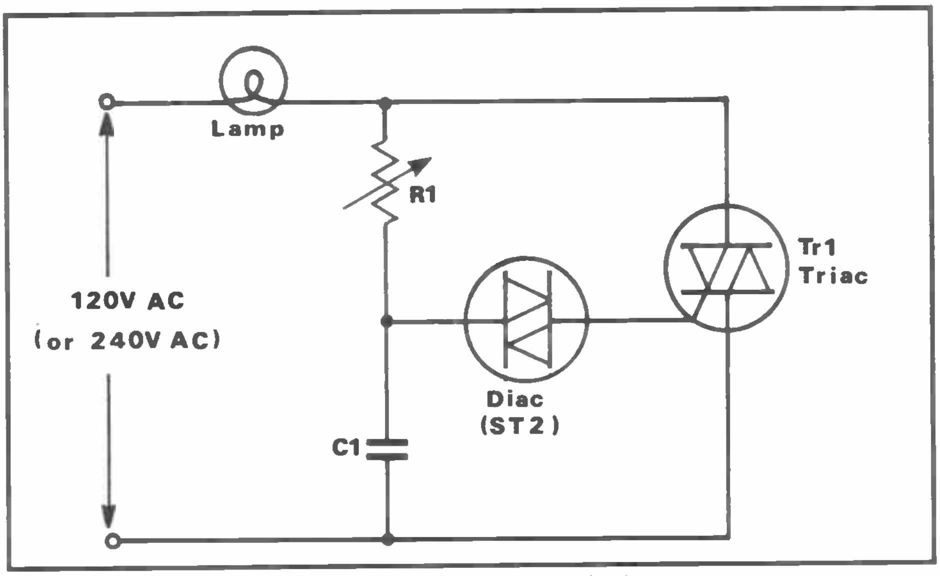


Fig 4: *Basic Diac-type variable phase-delay lamp dimmer circuit*

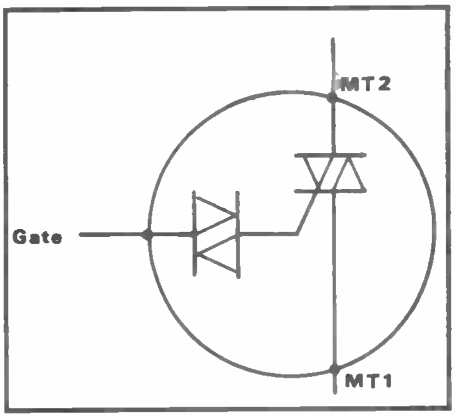


Fig 5: *Quadrac symbol*

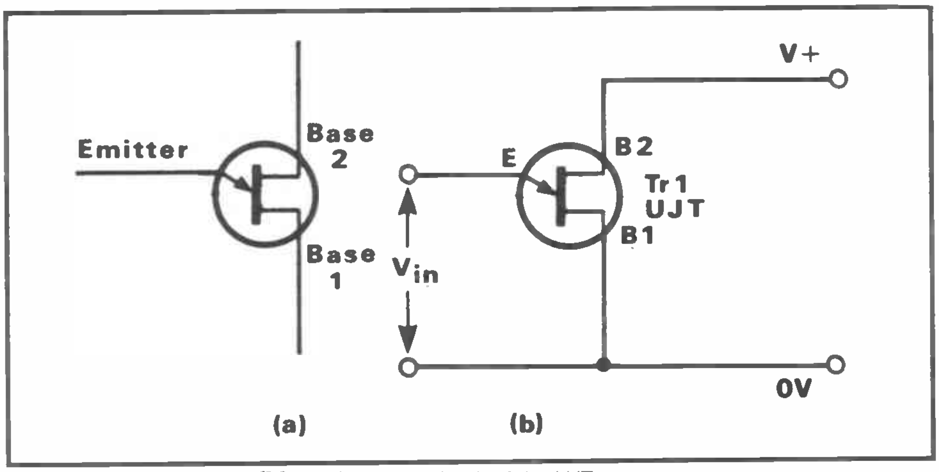


Fig 6 (a): *Circuit symbol* **(b):** *basic usage circuit of the UJT*

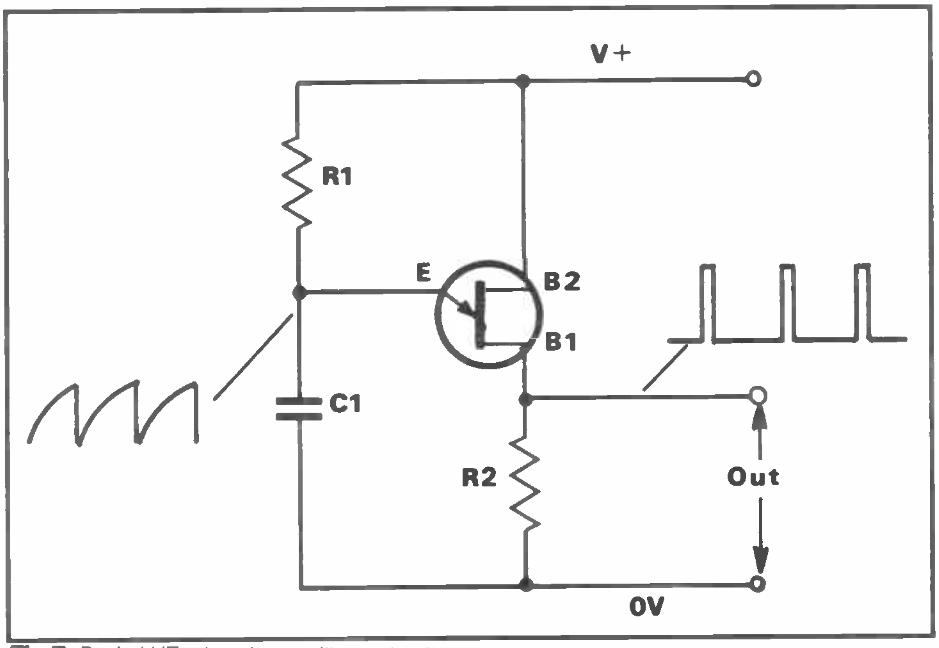


Fig 7: *Basic UJT relaxation oscillator circuit*

power control applications, as shown in the basic variable phase-delay lamp dimmer circuit of *Figure 4*. Here, in each power line half-cycle, the R1-C1 network applies a variable phase-delayed version of the half-cycle to the Triac gate via the Diac. Each time the C1 voltage rises to 35V in a half-cycle, the Diac fires and delivers a 5V trigger pulse (from C1) into the Triac gate, thus turning the Triac on and simultaneously applying power to the lamp load and removing the drive from the R-C network. Thus, the mean power to the load (integrated over a full half-cycle period) is fully variable from near-zero to maximum via R1.

Some Triacs are manufactured with a built-in Diac that acts in series with the Triac gate. Such devices are known as Quadracs, and use the circuit symbol shown in *Figure 5*.

The unijunction transistor

The unijunction transistor (UJT) is a 3-terminal trigger device that is often used to trigger SCRs or Triacs; *Figure 6a* shows the UJT circuit symbol. The UJT is normally used in the basic way shown in *Figure 6b*, with its B2 terminal taken to the positive supply rail and its B1 terminal grounded, and with an input signal voltage applied to its E (emitter) terminal; the action of this is as follows.

Normally, when the input (E) voltage is very low, the UJT exhibits a near-infinite E-to-B1 input impedance. If the input voltage is slowly increased a point is reached, at a 'peak-point' voltage (V_p) of roughly 60% of the supply voltage value, at which the input impedance starts to fall and the input starts to draw a trigger current. If this current is allowed to exceed a minimum 'peak-point emitter current' (I_p) of a few microamps, the UJT enters a regenerative switching phase in which the input impedance drops to a value of a mere 20 ohms or so. Once triggered, the UJT input impedance remains in the low state until the input current is reduced below a 'valley-point' value (I_p) of a few milliamps, at which point the input impedance starts to switch high again.

UJT oscillator

In practice, the UJT is usually used in a relaxation oscillator circuit that is shown in basic form in *Figure 7*. Here, the UJT input is taken from the C1-R1 timer network, and the output is taken from R2, which is wired between B1 and ground. This circuit operates as follows.

When power is first applied to the circuit C1 is fully discharged, so E is at zero volts and presents a near-infinite input impedance. As soon as power is applied, C1 starts to charge exponentially via R1 and thus generates a rising voltage on E. Eventually, after a period determined by the C1-R1 values, the E voltage reaches the peak-point value of the UJT and the input impedance starts to switch low. Under this condition C1 acts as a low impedance power source and the E-to-B1 impedance thus switches to a very low value, causing C1 to rapidly discharge into R2 and thus generate a brief but powerful output pulse until, eventually, the E input current falls below the UJT's valley-point value and the emitter reverts to the high impedance state and C1 starts to recharge via R1. This process then repeats ad infinitum, with an exponential saw-tooth waveform being developed at the C1-R1 junction and a pulse waveform being developed across R2.

Note that, for this circuit to work correctly, the R1 value must be large enough to limit currents to less than the UJT's I_v value of a few mA (ie, greater than a few kΩ), but small enough to allow currents to exceed the UJT's minimum I_p current of a few uA (ie, less than 500kΩ or so). Typically, R1 can have any value in the range 4k7 to 500kΩ, enabling pulse delay times to be varied over a wide range via R1 and making the circuit suitable for use in a variety of phase-delayed power control applications.

Isolated-input switching

A major attraction of the UJT oscillator is that it can generate high-current output pulses (up to several hundred milliamps) while consuming a fairly low mean current (a couple of milliamps). One important application of the UJT oscillator is shown in the isolated-input ac power switch circuit of *Figure 8*. Here, the oscillator is dc power via T2-D1-C2 and SW1 and operates at several kHz, thus delivering roughly 50 trigger pulses to the Triac gate (via isolation pulse transformer T1) during each ac power line half-cycle. Consequently, the Triac is triggered and self-latched via the first trigger pulse occurring in each power half-cycle, this appears within a few degrees of the start of the half-cycle.

The Triac is thus turned on almost permanently when SW1 is closed and virtually full power is applied to the ac load. The trigger circuit is, however, fully isolated from the ac power source via T1 and T2. It can be turned on and off by switching a few milliamps of dc current via SW1. In practice, SW1 can easily be replaced with any type of electronic sensing circuitry, which can be fully isolated from the ac power line.

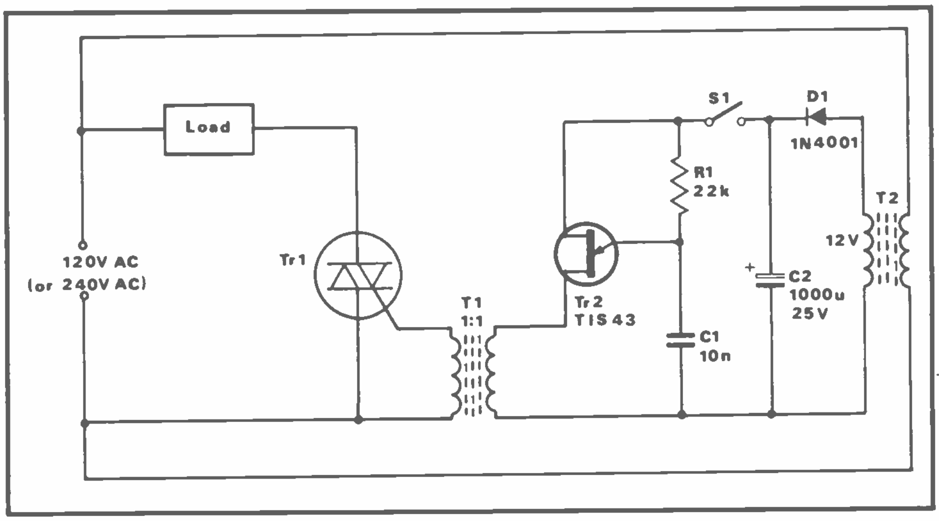


Fig 8: *UJT-triggered isolated-input ac power switch*

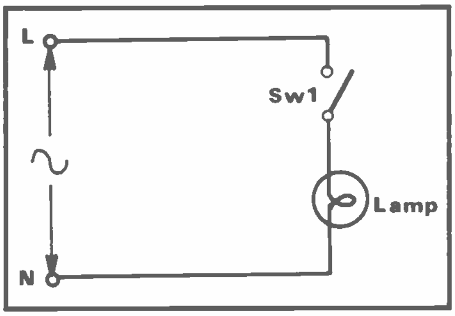


Fig 9: *Single-switch on/off ac lamp control circuit*

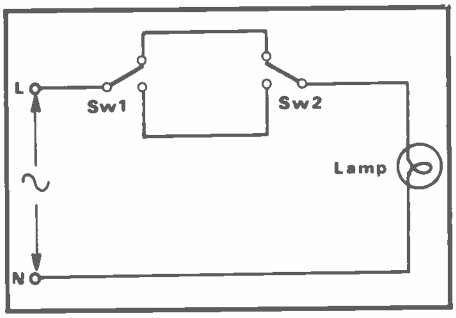


Fig 10: *Two-switch on/off ac lamp control circuit*

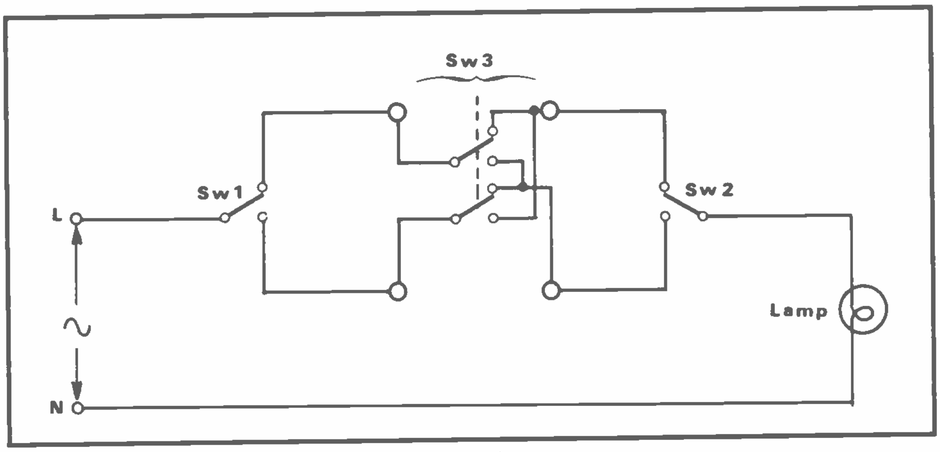


Fig 11: *Three-switch on/off ac lamp control circuit*

Having now completed our look at basic power control principles and devices, let's move on and look at a variety of practical power control circuits. We'll start off by looking at conventional lamp switching systems and then show how these can be replaced by relay-output electronic circuits.

Lamp switching circuits

The simplest type of power control circuit is that used for turning a filament lamp on and off. In ac mains-powered applications this circuit takes the form shown in *Figure 9*, with switch SW1 wired in series with the lamp, SW1 connected to the live, phase or 'hot' power line and with the lamp connected to the neutral or safe power line. This configuration minimises the consumer's chances of receiving an electric shock when changing lamp bulbs. The simple *Figure 9* circuit enables the lamp to be switched on and off from a single point only.

Figure 10 shows how a lamp can be switched on and off from either of two points. The circuit uses a two-way switch at each point and two extra wires (known

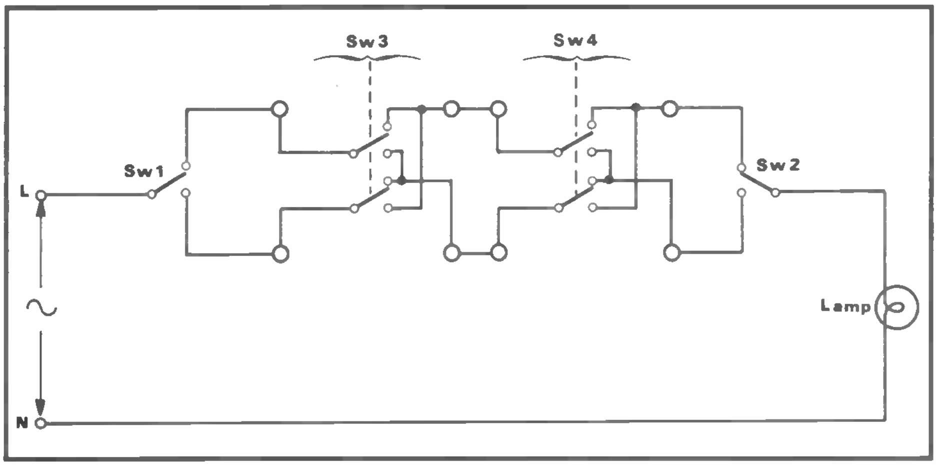


Fig 12: *Four-switch on/off ac lamp control circuit*

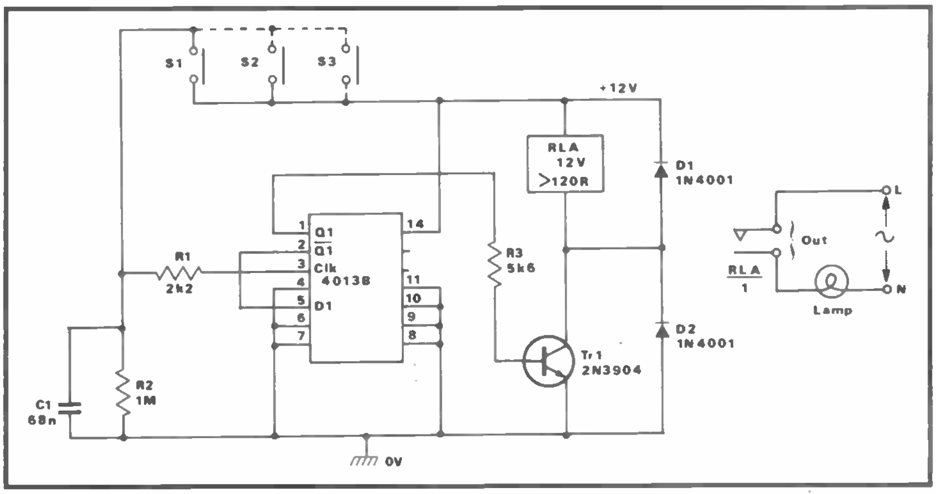


Fig 13: *Multi-input push-button on/off ac lamp control circuit*

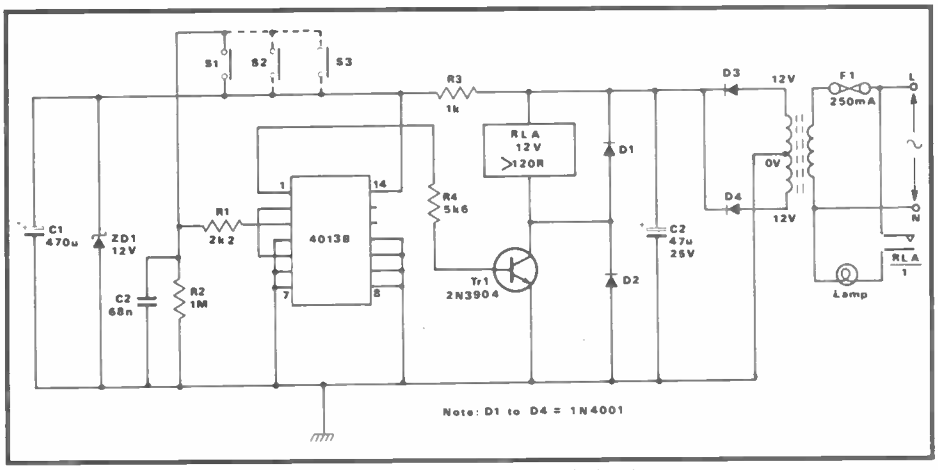


Fig 14: *Mains powered version of the push-button control circuit*

as strapping wires) connect these switches, so that one or other of these wires carries the current when the lamp is turned on.

Figure 11 shows how the above circuit can be modified so that it can be switched on and off from any of three different points. In this case a ganged pair of 2-way switches (SW3) is inserted in series with the two strapping wires, so that the SW1-SW2 lamp current will flow directly along a strapping wire path when SW3 is in one position, but will cross from one strapping wire path to the other when SW3 is in the alternative position.

Note that switch SW3 has opposing pairs of output terminals shorted together. In the electric wiring industry such switches are available with these terminals shorted internally and with only four terminals externally available (as indicated by the small white circles in the diagram). These switches are known in the trade as 'intermediate' switches.

In practice, the basic *Figure 10* circuit can be switched from any desired number of positions by simply inserting an intermediate switch into the strapping wires at each desired new switching position; *Figure 12*, for example, shows the circuit modified for four position switching.

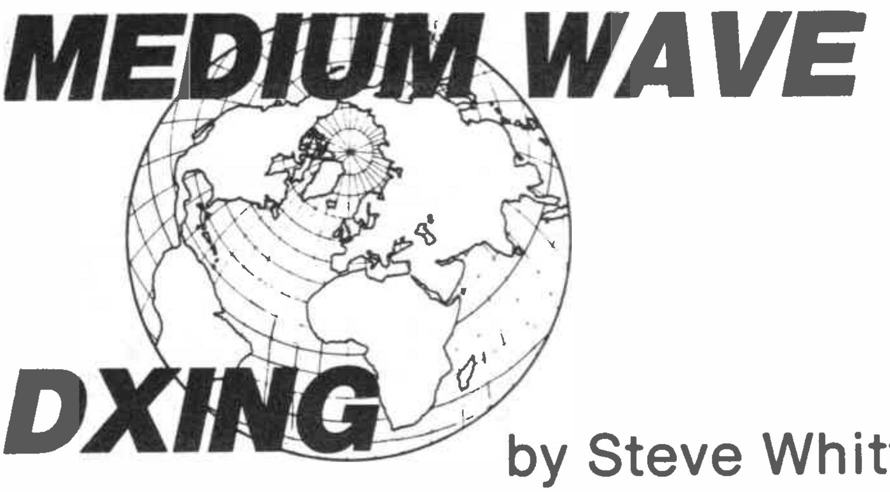
Multi-input switching circuits

Note that although the *Figure 12* circuit is electrically simple, it can in fact be quite difficult to install physically, since each intermediate switch needs at least a 3-core (live, neutral and ground) heavy duty cable feeding into it and a similar cable feeding out of it. These cables must be buried in channels cut into plaster and masonry if concealed wiring is to be used.

These installation problems can easily be eliminated by replacing the traditional electric switching systems with modern relay-output, multi-input, electronic switching systems. *Figures 13* and *14* show two examples of such circuits. In these circuits the lamp is activated via the contacts of a relay that is powered from a 12V dc supply. The relay changes state and turns the lamp on or off each time any one of a number of external push-button switches is operated, thus giving a binary relay switching action. The push-button switches operate at low currents and voltages, and are all wired in parallel. This means they can easily be connected to the relay unit via very thin twin cables that can easily be hidden from sight without the use of extensive channelling, etc.

The *Figure 13* circuit is dc powered and is designed around a 4013B CMOS dual D-type flip-flop IC that has one flip-flop disabled by grounding its input pins, and has the other wired as a divide-by-two stage by shorting its not-Q and D1 pins together. The input clock pulses of this divider need rise times of less than 15uS. These are obtained by operating one or other of the push-button input switches. Each time a button is closed, C1 charges rapidly via the switch, thus giving the fast-rise-time clock pulse. C1 discharges slowly via R2 when the switch is re-opened, thus eliminating false-triggering via switch-bounce effects etc. Hence, Q1 and the relay change state when the push-button switch is used.

The above circuit is designed for use with a 12V dc power supply. *Figure 14* shows how it can be modified for operation from the ac power line; in this case a 12V dc supply is derived via mains transformer T1, which gives a 12V-0-12V output at 100mA.



MEDIUM WAVE DXING

by Steve Whitt

A couple of issues back I took a brief look at some suitable receivers for the MW DXer. Making such a choice is quite a complex process, so this month I'd like to go into the matter in a bit more depth.

What is a communications receiver?

Many listeners wish to know what a communications receiver is and how they go about choosing one. There is no simple definition of a communications receiver but often what sets such a device apart from an ordinary radio is its need for an external aerial as opposed to the internal ferrite rod fitted to the majority of domestic units. For virtually all other forms of DX listening (such as short-wave or VHF) a specialised receiver will be needed, but fortunately for the MW enthusiast it is possible to get started with the most basic of domestic receivers since they all tune the frequencies of interest, ie 520kHz-1605kHz. Using this sort of equipment, it is possible to look for the weak signals that are found all the way down the dial between the strong locals, but after a while the newcomer to the MW band will start to appreciate the limitations of a basic domestic receiver and want something better. That is not to say that under the right conditions real DX cannot be heard on a simple receiver (indeed stations like CJYQ in Newfoundland and WHN in New York have been heard), but a communications receiver will make it a lot easier to hear.

In the main, a communications receiver is distinguished by its sensitivity, selectivity and the accuracy of its frequency read-out. Sensitivity is the measure of a receiver's ability to pick up and render audible weak signals. This is not so important on MW since many stations use vast transmitter powers. Furthermore, the limit to weak signal reception is rarely the receiver itself since the background noise on the MW band due to atmospherics (mainly tropical thunderstorms) and man-made electrical interference is so high. A good receiver will be sensitive but not overly so, since excessive sensitivity is often accompanied by the unwanted tendency to overload on strong signals.

The ability of a receiver to separate two radio signals on two different, but closely spaced, frequencies is termed its selectivity. This is a vital parameter if good MW performance is to be had from a receiver (domestic radios are usually very weak in this area) since the keen DXer will be trying to separate stations that may be as little as one or two kHz apart on the dial. This is very much the case if you are hunting transatlantic DX on frequencies between those used by European broadcasters. A good communications receiver will have several different switch-selectable bandwidths ranging typically from 2 to 10kHz.

It is pointless for a receiver to be able to separate closely spaced signals unless the user is able to identify which frequency is being resolved. This is why most communications receivers will have accurate dials or frequency read-outs; either mechanical scales or dials, or the more modern digital frequency read-out. Read-out to 1kHz accuracy or better is desirable on MW.

To get started on the MW band with a communications receiver could set you back anywhere from £50 to £2,000, depending on the sort of equipment chosen. Over the years hundreds of different receivers have been made, all with their pros and cons and to do them all justice would fill a book.

There are some general tips worth bearing in mind when choosing a receiver. Broadly speaking communications receivers have gone through three phases, namely the valve based units of the 1950s and '60s, the early solid state receivers of the '60s and early '70s and finally the transistorised receivers developed since about 1975. For the DXer on a budget the best bet is one of the receivers in the first category, some of which have justifiably become quite famous such as the RCA AR88D, Murphy B40, Marconi R1155 and the Eddystone range of receivers. In general one can expect these units to be heavy and robust with good dials and very good reception on MW. If they have one limitation it is that they tend to run out of steam above 20MHz, but this is of little concern to the MW DXer. Typically, receivers of this class can be bought second-hand for £50-£150 but you may end up paying more if you purchase 'professional' receivers from this era such as the Motorola R390A, Drake R4, or the Racal RA17.

Quite often you will see receivers such as the Eddystone EB35 or EC10 or the Realistic DX-300 advertised quite cheaply second-hand – steer clear of these as they represent the second category. A problem that afflicted the vast majority of early transistorised receivers was their susceptibility to overload. By the mid-seventies transistorised receiver designs were beginning to match the performance of the valved receivers of the '50s. OK, they had all the extras such as digital read-out, frequency synthesis and many other facilities to make the DXer's life easier but in terms of true DX hunting ability they were still no better. The latest developments, since 1980 say, have almost entirely been driven by the Japanese companies (except for recent military equipment which probably won't be surplus for another decade!). Some of these receivers are ideal for the serious MW DXer (eg Icom R71 or NRD525) but be prepared to part with the sort of cash that would buy a second-hand car!

Newsdesk

Andorra: For some years now Andorra has maintained radio silence and recent reports suggest little change. The famous castle-like building of Radio Andorra at Encamp in the Pyrenees is abandoned and the site overgrown. However, the two tall MW antenna masts are still standing on a nearby mountain ridge and there is still a log-periodic SW aerial in the backyard. Apparently the transmitters are still in the building. The second station silenced a few years back was Sud Radio. Their former offices in Andorra La Vella are abandoned and locked up. The mountain-top transmitter building at 2650 metres above sea level near the French border still stands but the aerials have been dismantled. All Sud Radio activities have been transferred to Toulouse in France and the only active broadcaster in the country is a local FM station called Radio Valira.

Eire: After months of uncertainty, Radio Tara, the joint long-wave venture between RTE and Radio Luxembourg, seems to be about to proceed. Recently, the appeal against planning permission for the massive aerial (which is to be sited close to a residential area) for Radio Tara has been rejected and the station says construction will now start.

531 Sunshine 101 seems to have raised power since July.

1008 Both North West CR and Kiss FM have left this channel.

1521 Radio Rainbow has moved its transmitter to Co Roscommon and is expected to return to the air soon.

1611 Further to the item in this column last month, the mystery station on this frequency has identified itself as Radio Fax, operating from a 200W facility installed in Co Louth. It uses MW at night and automatically switches to 6205kHz SW during the day. The aerial was formerly used by Radio Rainbow on 1521kHz and this explains the silence of the latter station. Although the transmitter is in the Irish Republic to avoid the attention of the DTI, in the UK the station is run from an English address: The Forge, Lucks Green, Cranleigh, Surrey GU6 7BG. Trevor Brook, the station owner, has applied to the authorities on several occasions for a low power shortwave licence in order to operate a commercial media/radio/electronics oriented station for listeners in Europe. His applications have not been successful. The official response seems to indicate that the government is not interested in either liberalising the airwaves or opening them up to market forces. As far as short-waves are concerned, it seems that the BBC World Service will remain the only approved 'Voice of Britain' for some considerable time to come.

Germany FRG: 1269kHz DLF K81n. DX Circle with Alan Thompson returned to the air on 6th September and it can be heard every alternate Tuesday at 1915-2000hrs.

Mexico: 690kHz XETRA Tijuana. This station was one of the famous Mexican border blaster stations of the 1950s and '60s immortalised by Wolfman Tack in the film *American Graffiti*. Sadly, ending an era, XETRA is dropping its rock music for all talk radio.

United Kingdom: BBC Radio London is to be re-launched this autumn with the title GLR (Greater London Radio) with programmes targeted at the 25-45 age group. Also in London, Swinging Radio England continues to operate on 1611kHz despite interference from Radio Fax.

Travellers' Information Service (TIS) might be a reality in the UK soon. Radio Mercury plans to apply for a licence to operate an information based radio service for motorists heading for Gatwick Airport. With an eight mile coverage range, operation for 18 hours per day is planned using recorded announcements of airport information and flight changes.

Special Event Radio: this year information on planned stations has been thin on the ground due to changes in the rules regarding licence applications. Since stations need only apply for their licence six weeks prior to operation, details often arrive too late to meet magazine production deadlines. However, a couple of stations which will have been and gone by the time you read this, are worth recording. From 9-17th September a station calling itself Offshore Radio operated the first commercial radio station from the island of Guernsey. It was linked to the offshore power boat races. In August, Turkish Community Radio operated from the London Festival site at Alexandra Palace in London. Their low power signal on 1503kHz was heard, amazingly, as far away as Reading and Luton and could be detected in Ipswich.

DX file

When I hear a new station I often write to them informing them of this fact and requesting a QSL verification. Earlier this year I wrote to Boston station WBIV and six months later hadn't heard anything. Imagine my surprise then to be woken at 3am one Sunday morning by a phone call from the station. As I crawled out of bed to answer the phone it became evident that the talk show host, who called and put me live on air for 10 or so minutes, hadn't realised that we were five hours ahead of the time in Boston!

As I write this column the equinox is almost upon us and the winter DX season is back with a vengeance. In one evening recently between midnight and 0200hrs UTC I could hear about 20 stations from North America. On this particular occasion several things were notable; firstly all the audible DX was on frequencies below 1100kHz and secondly several stations that are only rarely heard (eg WMCA, New York, 570kHz and WBIV, Boston, 1060kHz) at my location in Ipswich, were giving out quite good signals. Also, on 900kHz a French-speaking station, presumed to be CJBR, was audible even though the Italian station on the channel was still operating!

Unfortunately, I've not heard what better placed DXers have heard recently but now that the Royal Mail is moving again, I look forward to receiving your reports.

ATV ON THE AIR

Andy Emmerson G8PTH puts you in the picture

Professionalism at the NEC

Ah well, we can hope. Good news, you may remember that the BATC was asked by the RSGB to televise the royal opening of this year's national convention in Birmingham. This was a great success – eventually. At the RSGB's expense, the club hired professional equipment in a bid to prevent any possible hiccups.

The camcorder was a Betacam and this provided excellent pictures, so no complaints there. The cable, which fed the vision from the Lucas Suite to the main hall went down during rigging but the problem was located and fixed in time. The hired sound mixer failed on the shoot, so the only sound recorded was from the camera's own microphone. All went well otherwise, and the recorded sound and pictures seem to have satisfied the 'client'. The BATC lighting was used by Central Television for their coverage and BBC local radio used a feed of 'our' audio. Not bad for a bunch of amateurs, though when you turn up with professional equipment, people always think you know what you are doing.

So it was a job well done. Congratulations to Trevor, G8CJS and his team of willing helpers for their successful effort. Thanks are also due to the RSGB for having the confidence to use the BATC and to Bob Platts and Bob Robson for their work on the shoot. Bob Robson travelled 775 miles to pick up the camera and return it. In addition, he collected a dub of the rushes to play on the BATC stand afterwards.

SSTV misunderstanding settled

You will recall the arguments for and against the 'migration' of SSTV from its traditional (and band-plan) home of 14.23MHz. Lew Tepfer, W8FVV, of the International Visual Communications Association (IVCA) writes: 'Mr Stone is reporting out of context. At the SSTV meeting in Dayton, a question was raised about heavy QRM on 14.230. It was suggested that 14.35MHz should be used as an alternative frequency, not a replacement; possibly to hold some nets and to be used as an alternative during contests. The IVCA would never suggest giving up or abandoning 14.230. It is, and should be, a standard. However, we are encouraging growth in the number of SSTVers and, consequently, are suggesting alternative frequencies so that all may enjoy this activity.

'I believe that the RSGB should get involved in any item that materially affects ham radio. They should also be certain that all the facts are accurately known prior to making a stand. Best 73s to you and your members'.

This seems to make a lot of sense and I am happy to set the record straight; we need to stand together on this issue.

So say all of us

On the same topic, Roland, G4UKL writes: 'IVCA seem willing to grasp the nettle no-one else has the courage to do. It is up to the three IARU Region band planning committees to get their act together, or at the very least, agree with each other! IVCA has a very considerable international membership and the representations it can make directly to controlling bodies are on that basis. They claim to be the only organisation whose interests are entirely SSTV-oriented and staffed entirely by volunteers. Unlike other organisations, not ham-strung by ponderous committees of reactionary "old-timers", which, having only a vague notion of the needs of modern amateur television, are confined to memories of the defunct P7 era.

'I have mentioned before how utterly stupid it was to site SSTV in the middle of the bands. The "younger generation" of SSTVers are ham-strung with the short-sightedness of earlier planners. WB0QCD's defence of 14.23 as the sole SSTV frequency may have had some credence 25 years ago, but with the great increase in the numbers of people in the hobby all wanting air-space, coupled with current technology (colour transmissions only take 72 seconds or even 96 seconds to complete), are becoming commonplace. The need for an alternative QRM-free location is of paramount importance.

'Today, as fast as one R/T station is persuaded to move from 14.23 or nearby, another opens up. His solution of sweet reason is decidedly inadequate, you can spend more time trying to clear the frequency than using it! The world-wide numbers of radio amateurs, many of whom have no knowledge of HF band-plans, ensure a never-ending stream of interference on 14.23. Try asking an Italian group or DX net to QSY!

Dark hints!

'I am intrigued with the vague reference to SSTV "cliques" Mike Stone writes about, can we be enlightened? Equally fascinating is the darkly hinted motivation behind the IVCA's attempt to get some sense into the SSTV scene. Details please. It would also be useful to know what the other bodies claiming to represent SSTV interests have done in this respect. The RSGB ought to be doing something: how about some publicity in the weekly news bulletin and why not a full-page in *RadCom* on HF band plans? The RSGB are members of the IARU Region 1 which is meeting soon.

'WB0QCD draws attention to the "established" phone-patch groups at the top end of 20m. Does he not know this activity is illegal in the UK and most other continental countries? Are amateurs in these countries to be denied access to these frequencies, so that the privileged can enjoy cheap phone calls? Mike Stone knows as well as anyone that under the present licence conditions, no amateur has an exclusive right to a frequency, slow-scanners included. I think SSTVers show remarkable restraint in keeping to the IARU band-plans. It will be a sad day for amateur radio if hams choose, as so many DXers, phone patchers and nets do, to ignore band-plans and work all over the bands.'

Strong stuff and well argued – does anyone disagree? In the meantime, if you wish to get in touch with the IVCA, their address is: International Visual Communications Association, 99 Oenoke Lane, New Canaan, Conn 06840, USA. It may be as well to mention where you got the address.

Trigain-a-deg cm

The above is supposed to be 70cms in Welsh; I wonder how you say amateur television in the same language? Never mind, here is a report from Eric, GW8LJJ, in Barry, South Glamorgan . . .

'It was a nice Sunday so I decided to take the 70cm mobile (well, it was either that or gardening!). I clamped a camera on the dash of the estate car and set up the transmitter on the passenger seat. I drove with a collinear on the roof from Barry (South Glamorgan) to Blackwood (Gwent), stopping at times on high spots but with little result. Carrying on through the valleys, Peter, GW4EAI, called on 2m, saying "Watch that car in front!". He was receiving my mobile pictures six miles away (P5 at times). Near to Blackwood, Keith, GW8TRO joined in to say he was receiving colour pictures'.

GB3ET, the ATV repeater on top of the Emley Moor television mast in Yorkshire, has been licensed. The aerial will be installed in the near future, followed by switch-on soon after. GB3RT, near Rugby, was finally switched on a few months back and continues to give excellent service over a sizeable area. When it moves to a more elevated site, coverage should be further improved.

Michael, ZL1ABS, has been busy in New Zealand after his trip to Dayton. He is currently building an amplifier for 70cm ATV, using two 12V BLU45 transistors. Michael is also helping out another BATC member, Ray, ZL1BDU, by wiring up a ZL2TAR-type colour pattern and callsign generator.

That is all for this month. I look forward to receiving many more reports for the next round-up. REW

NETWORK 934

Andy Emmerson G9BUP

John, UK581, our regular Midlands correspondent (now also G7ATP – congratulations) has been thinking about the implications of SRR, the Government's new short range radio system due to be launched during 1992.

He finds it inconceivable that such a potentially useful service should be limited to hand-held sets, especially when the draft specification includes mobiles, base stations and repeaters. The whole idea is that SRR should be a uniform system throughout the so-called CEPT countries of Europe. (CEPT, the Conference of European Postal and Telecoms Administrations, agrees standards for public radio and telephone systems, among other things). The hand-helds only idea is reportedly the desire of the Department of Trade and Industry, though their reasoning is not clear – perhaps they will let us know if they read this column!

The 934MHz band is perfectly capable of ranges up to five miles in typical base-to-mobile situations and would appear to be everything that small businesses and professional people need, not to mention hobbyists. By restricting SRR to hand-helds, the range would be restricted to extremely short distances. For on-site use at factories, construction yards and sports events, it would be ideal, but these applications will hardly ensure the commercial success of the new service. Let us hope they will reconsider this.

Considerable potential

'If the full range of mobile and base station working is allowed, the new SRR could have a bright future', suggests John. One of the largest business radio dealers in the Midlands is already extremely enthusiastic about SRR's potential. After all, conversations will be proof against interruption and eavesdropping; this is a feature offered by no other business radio system. Cellular and PMR (private mobile radio) are scarcely confidential nowadays when every 'earwig' has a scanner! SRR's appeal to hobbyists is unlikely to be as great, however. 'Privacy is all very well', says John, 'but hobbyists are more sociable and like to know who's on the band'. SRR has no CQ facility and no band-scanning, while a built-in call timer mechanism limits the length of 'overs', even if you and your QSO partner are the only people on the air at the time. The simplex system we know and love is better suited to our own needs!

The SRR band will be protected from interference from 934MHz CBers because the SRR channels are to be offset by 12.5kHz. 'Fine', says John, 'but what if an off-channel "Rufftek" fires up and obliterates three channels locally (as some do)? Business users might get rather upset and start complaining'.

Actually, with the current activity level on 934MHz, I think any interference is highly unlikely. Perhaps all the 'Ruffteks' will have self-destructed by 1992!

Current activity

There are still quite a few stations on the air in the Midlands, reports John, as well as pockets of activity in the Liverpool and Manchester areas. (Write in and tell us where else). In fact, in his area, nine hams own 934MHz sets and transceivers can be picked up quite cheaply now that several 'less committed' people have given up (possibly due to the unfounded rumours that the band will be withdrawn in 1990). This is untrue. The Government has stated that users can continue using their sets for the length of their practical use.

A second set makes good sense, either as a back-up or permanent addition for the car or whatever. If you have problems with the rig, it is handy to be able to swap mikes with another set of the same kind and try to narrow down the fault. Prices seem to vary. In the South East, I am told you can pick up a Delta One for £100, though you will have to pay £200 in the West Midlands. A Commtel NPR was offered at around £130 at the Derby rally recently and might be a good set to buy as a base station. It appears the NPR does not have very good noise filtering, so as a mobile it suffers from a lot of interference. On the other hand, it is sharply tuned and rejects out-of-hand interference from cellular radio extremely well; reportedly better than the Delta One. Personally, I think its styling beats the Delta, although its mic socket looks a bit delicate and could make swapping mikes difficult.

Activity, what activity?

Having said the Midlands is still an activity centre, John admits that it can be a bit patchy. Many people complain that 934MHz is quiet – but they do not come on and work the band. Just shouting CQ for five minutes and then giving up in disgust is bound to lead to disappointment. The trick is listening and finding the regular nets and activity periods, then joining in. Most nets are run by friendly folk and you will gain by talking to them – and more folk may then wish to join in. Obviously, you cannot expect the band to be busy twenty-four hours a day.

Checking the weather and observing the signs will often give you clues to when conditions are picking up and when you might be able to work a bit of DX. Great fun.

Envoi

That is it again for this month. As it is autumn, we are due for some tropospheric openings: let me know the best DX you work and let us hear about some activity in your area. What is the going price for a Delta where you are? Letters, care of the editorial staff at *Radio & Electronics World* please. REW

AMATEUR RADIO WORLD

Compiled by Arthur C Gee G2UK

Why QRP?

Listeners to the CW section of 80 metres will, without doubt, have come across the activities of the QRP Group on CW. Considering the power – or rather lack of it – they use, it is intriguing to hear how well they manage!

In the feature 'QRP' in the August 1988 issue of *RadCom*, the author, George Dobbs G3RJV, draws attention to the remarkable interest now apparent in this aspect of the amateur radio scene.

He writes: 'Never since the time I first began my interest in QRP operating and building suitable equipment, has there been such interest in this aspect of our hobby. The continued and amazing growth of QRP groups world-wide; the inclusion of QRP related items in amateur radio magazines and the proliferation of QRP as a major special interest grouping within amateur radio, contrast with the view held until recently that QRP was the pursuit of a few odd radio amateurs.

'The recent discussion of licence condition changes and the current accent on amateur radio and youth with the student licence proposals seem to point to fundamental concerns about amateur radio as a hobby.

HF bands

'The use of power on the HF bands has been a contentious issue since the time when it became possible for amateurs to produce considerable RF power within their budget and technical capacity. If we ignore HF propaganda broadcasting, most radio services appear to adopt a professional approach to the use of power and aim, or are legislated, to use only sufficient power to provide satisfactory communication. This makes sense as it reduces mutual interference and improves their frequency utilisation.'

George goes on to say that QRP operators tend to use relatively simple equipment, often built themselves. This could lead to the 'Age of the Constructor'. Solid state construction can be done on a tea tray on the kitchen table and packed away at the end of each session. When an amateur radio guest is shown someone's shack, it does not matter whether the equipment is expensive and impressive. Any home-made equipment, however, will catch his eye and prompt questions.

It is interesting to note that a new 80 metre CW QRP transceiver kit has appeared on the market. Known as the DTR 3 transceiver, it is complete to the last nut and bolt, with wire and a screen printed steel case. It is a direct conversion circuit with full VFO coverage of the band 3.5 to 3.6MHz. To get on the air with it, just a key, 12 volts and an aerial are required. It gives 1.5 watts of RF output and costs £74.25. Details from: Lake Electronics, 7 Middleton Close, Nuthall, Nottingham NG16 1BX.

50MHz activity

Since the relaxation in June of last year of the licensing regulations concerning 50MHz operation in the UK and the improvement of propagation conditions, activity on 50MHz has increased greatly. This has no doubt been encouraged by the availability of commercially built gear, which has been marketed to meet the need. However, the activity growth has also come about because of the relaxation of the licensing regulations in other countries, especially our near neighbours in Europe. In October last year there was an opening to Botswana, which was very fruitful for a number of stations in the north of this country, including G2ADR and G4GAI in Lancashire, G3CCH in Humberside and GM4DGT in Alloa, a distance of about 9,000km. These contacts were the first G and GM to southern Africa QSOs on 50MHz. In June this year, Sporadic-E conditions gave openings to Portugal, Spain, Gibraltar, Malta, Greece, Norway, Iceland, Finland and Sweden. The first QSOs to America also took place in June. Ken Ellis, G5KW, who writes a 50MHz feature in our sister magazine *Amateur Radio*, has been trying to get a 'countries worked' list going. He comments that the main problem has been deciding which countries have official legal status. 50MHz operators are asked for their co-operation in helping him make this record as complete as possible.

UoSAT-C project changes

The third UoSAT spacecraft project UoSAT-C, which was to be the successor to UoSAT-1 and 2, and to have broadly similar objectives to them (ie carrying engineering, science and satellite communication experiments) was planned for launch in the last quarter of 1988. Its final design was proceeding at high speed, with many of the plans completed and circuits laid out using computer-aided printed circuit layout facilities. A new modular structure, with module boxes milled out of solid aluminium billets, was under way and GaAs solar cell panels were being provided by Japan. A very tight schedule was being worked, to prepare the spacecraft for the launch date. NASA had agreed to provide a launch on a Delta launch vehicle scheduled for take-off in late 1988. However, changes in this NASA/USAF launch programme have meant a postponement of the UoSAT-C mission. At the same time as the news of this delay, UoSAT signed an agreement with Arianespace for the launch of two further satellites into an 800km polar sun-synchronous orbit on an Ariane launcher which would be launching the SPOT-2 primary payload early in 1989. The Ariane launch opportunity was secured after long negotiations between UoSAT, AMSAT-NA and Arianespace and involves a total of seven payloads: SPOT-2 – a replacement for the SPOT-1 imaging satellite, UoSAT-D, UoSAT-E and four AMSAT-NA Microsats. UoSAT-D and E will now take over the objectives of the postponed UoSAT-C mission.

ASAP

UoSAT-D and E spacecraft, together with the four AMSAT-NA Microsats, will be placed around a new Ariane structure specially designed to provide facilities for small secondary payloads. This is designated 'ASAP' – Ariane Structure for Auxiliary Payloads. Due to weight limitations on the ASAP, the payloads originally intended for UoSAT-C will have to be divided between UoSAT-D and E. These two spacecrafts will have identical structures and housekeeping subsystems, but they will carry different payloads. UoSAT-D will carry an amateur radio digital 'store-and-forward' communications transponder, operating in the amateur radio satellite service and it will also carry equipment for investigating the effects of space environment radiation on spacecraft components. UoSAT-E will carry orbital technology and CCD camera experiments.

UoSAT-D will cost around £350. The Royal Aerospace Establishment is funding the radiation experiments and contributing to the cost of the spacecraft itself, and various other organisations are also contributing to the project. One of these is AMSAT-UK, which has undertaken to fund the project to the tune of £25,000. This is an extremely creditable offer, particularly in view of their recent financial help towards the launch of Oscar 13. They have opened a fund especially for this project entitled the Delta Fund and we understand contributions are already coming in.

Space debris

We have referred before to the fear that there is now so much debris from disintegrated hardware in space that it is becoming a hazard to satellites in orbit and similar spacecraft activities. We quoted reports that the launch vehicle from which RS 2 and 3 lifted off nearly five years ago, had exploded over India on 9th May. It was thought to be the first occasion when 'fragments' of spacecraft had caused such an event.

A recent European Space Agency press release highlights this problem. It points out that in the early days of space exploration one of the great fears was that spacecraft would be destroyed by collision with natural meteoroids. This fear has proved to be unfounded; the flux of meteoroids was low.

In 1985, the ESA held a workshop on the re-entry of space debris. In December 1986, ESA created a working group on space debris. This discussed collision hazards in the geostationary orbit 36,000km above the earth; the risks created by space debris to spacecraft and manned missions in low orbit and the re-entry of satellites broken up by the atmosphere. This group has met several times at ESOC. A report on its findings and recommendations will be available towards the end of 1988.

Norad

Since the beginning of space exploration, with the launch of Sputnik on 4th October 1957, there have been more than 3,000 launches resulting in about 3,600 satellites being placed in orbit. There are more than 7,000 man-made objects being tracked in orbit of which only a few hundred constitute operating payloads.

At present the major work on space debris is done by the USA and the USSR. In the USA, the task is assigned to the North American Air Defence Command (NORAD). Deep inside the Cheyenne Mountains, near Colorado Springs, the NORAD Space Surveillance Centre is hard at work tracking 7,000 orbiting objects the size of tennis balls or larger. Many of these are fragments from explosions in space; discarded rockets, eject covers, or even screwdrivers and spanners dropped by an astronaut while out for a stroll!

Solar cycle No 22

More evidence is pointing to the current solar cycle being exceptionally active. It started earlier than expected; sunspot activity had advanced in fits and starts with an unexpectedly rapid rise from the previous sunspot minimum. Past experience shows that a rapid initial rise is followed by a large maximum. Present opinion suggests that Cycle 22 will peak around 1990, with a maximum sunspot number of around 175. It has been suggested that Cycle 22 could be second only to Cycle 19, which was the most active cycle on record.

New amateur radio magazine

As part of the RSGB's Project Year, a pilot issue of a magazine for beginners in amateur radio was launched at their 75th Anniversary Convention. Called *DIY Radio*, it is proposed to produce it as a monthly, beginning in 1989 if the pilot issue proves successful.

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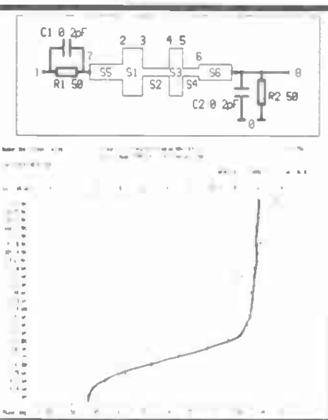

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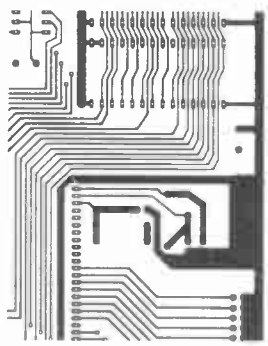

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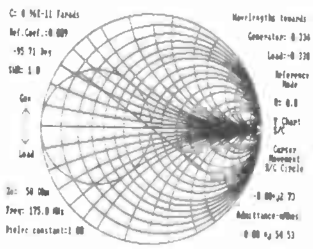

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SOLAR POWERED NI-CAD CHARGER 4 Ni-Cad batteries AA (HP7) charged in eight hours or two in only 4 hours. It is a complete, boxed ready to use unit. Price £6. Our ref. 6P3.

50V 20A TRANSFORMER 'C' Core construction so quite easy to adapt for other outputs—tapped mains input. Only £25 but very heavy so please add £5 if not collecting. Order Ref. 25P4.

15A PANEL METER These have been stripped from Government surplus battery charger units made originally for army use. Unused, tested but of course rather old, diameter 2in can be surface or flush mounted. £3 each. Our Ref. 3P40.

SWITCH AC LOAOS WITH YOUR COMPUTER This is easy and reliable if you use our solid state relay. This has no moving parts, has high input resistance and acts as a noise barrier and provides 4kW isolation between logic terminals. The turn-on voltage is not critical, anything between 3 and 30V, internal resistance is about 1K ohm. AC loads up to 10A can be switched. Price is £2 each. Ref. 2P183.

METAL PROJECT BOX Ideal size for battery charger, power supply etc.; sprayed grey, size 8in x 4¼in x 4in high, ends are louvred for ventilation other sides are flat and undrilled. Order Ref. 2P191. Price £1.

BIG SMOOTHING CAPACITOR. Sprague powerlytic 39,000uF at 50V. £3. Our ref. 3P41.

4-CORE FLEX CABLE. Cores separately insulated and grey PVC covered overall. Each copper core size 7/0.2mm. Ideal for long telephone runs or similar applications even at mains voltage. 20 metres £2. Our ref.2P196 or 100 metres coil £8. Order ref. 8P19.

6-CORE FLEX CABLE. Description same as the 4-core above. Price 15 metres for £2. Our ref. 2P197 or 100 metres £9. Our ref. 9P1.

BULK-HEAD MOUNTING LOUDSPEAKER. Metal case with chrome grill front and with mounting lugs for screwing to ceiling, 8in. speaker. £10 each. Order ref. 10P43 add £2 post.

TWIN GANG TUNING CAPACITOR. Each section is .0005uF with trimmers and good length ¼in spindle. Old but unuse3d and in very good condition. £1 each. Our ref. BO630.

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CAPACITOR BARGAIN—axial ended, 4700μF at 25V. Jap made, normally 50p each, you get 4 for £1. Our ref. 613.

PIEZO ELECTRIC FAN—An unusual fan, more like the one used by Madame Butterfly than the conventional type, it does not rotate. The air movement is caused by two vibrating arms. It is American made, mains operated, very economical and causes no interference, so is ideal for computer and instrument cooling. Price is only £1 each. Ref. BO598.

SPRING LOADED TEST PRODS—Heavy duty, made by the famous Bulgin company. very good quality. Price 4 for £1. Ref. BD597.

ASTEC P.S.U.—Switch mode type. Input set for +230V. Output 3.5 amps at +5V, 1.5 amps at +12V, and 3 amps at +5V. Should be OK for floppy disc drives. Regular price £30. Our price only £10. Ref. 10T34. Brand new and unused.

APPLIANCE THERMOSTATS—Spindle adjust type suitable for convector heaters or similar. Price 2 for £1. Ref. BO582.

3-CORE FLEX BARGAIN No. 1—Core size 5mm so ideal for long extension leads carrying up to 5 amps or short leads up to 10 amps. 15mm for £2. ref. 2P189.

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ALPHA-NUMERIC KEYBOARD—This keyboard has 73 keys giving trouble free life and no contact bounce. The keys are arranged in two groups, the main area is a QWERTY array and on the right is a 15 key number pad, board size is approx. 13" x 4"—brand new but offered at only a fraction of its cost, namely £3, plus £1 post. Ref. 3P27.

WIRE BARGAIN—500 metres 0.7mm solid copper tinned and p.v.c. covered. Only £3 plus £1 post. Ref. 3P31—that's well under 1p per metre, and this wire is ideal for push on connections.

INTERRUPTED BEAM KIT—This kit enables you to make a switch that will trigger when a steady beam of infra-red or ordinary light is broken. Main components—relay, pnoto transistor, resistors and caps, etc. Circuit diagram but no case. Price £2. Ref. 2P15.

3-30V VARIABLE VOLTAGE POWER SUPPLY UNIT—with 1 amp OC output. Intended for use on the bench for experimenters, students, inventors, service engineers etc. This is probably the most important piece of equipment you can own (after a multi range test meter). It gives a variable output from 3-30 volts and has an automatic short circuit and overload protection, which operaes at 1.1 amp approximately. Other features are very low ripple output, a typical ripple is 3mV pk-pk, 1mV rms. Mounted in a metal fronted plastic case, this has a voltmeter on the front panel in addition to the output control knob and the output terminals. Price for complete kit with full instructions is £15. Ref. 15P7.

STEREO SPEAKERS Each 10 watts 8 ohm and twin speakers mounted in walnut finish cabinets, size 16in high x 10in wide x 6in deep. Front is black Oacron and the finish is very pleasing. Price £7 per pair. Extra postage and packing £3. Our Ref. 7P6.

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