RADIO SCIENCE RESULTS

The VKØIR logs*

The VKØIR logs were entered directly into the computers during radio operations, using CT 9.27 as the logging program. The computers were not networked, and were used in "Expedition" mode.

Each day at about 0600Z (11:00 AM local) when the rates were about as low as they got, Bob N6EK collected the latest version of the log from each of the six HF stations, the RTTY station and the satellite station. Each day these logs were merged with each other and with the previous day's logs. Collecting the logs and merging them took a couple of hours.

The original plan had been to connect the six main logging computers using a loop network which would have meant that each contact would normally be logged on all computers for redundancy. During the training sessions on the boat we discovered a bug in networked CT: Whenever we went back and corrected the callsign in a QSO that had already been logged on one computer, the cursor was repositioned on all the other computers in the network. This was viewed as a very serious impediment to correct logging and led to the immediate decision not to connect the computers by a network.

Without the redundancy provided by the network, we decided to use the autosave feature of the logging program which would cause the log to be saved to a floppy disk once an hour. Fortunately we never had a computer malfunction and did not have to rely on these floppy disks to recover logged contacts, since as much as an hour's worth of contacts could have been logged on the computer but not copied to the floppy disk. A side effect of using the autosave feature was that at the top of the hour, each computer froze up for what seemed like a long time while the floppy disk was written. In fact, we truncated the log on each computer at about five thousand contacts in order to keep the length of the freeze short enough to be tolerable.

Each operator logged on paper the time and contact number of the first and last contact made on each band during his shift. There was one of these paper logs for each station. A major concern was to make sure all contacts were logged on the correct band and mode, since this had been a weakness of previous expeditions. To a first approximation, the CT logging program interrogated the radio during each contact to obtain the band and mode information, but there were two problems with this. First, the communications between the radio and the computer

**The text in this section, and most of the log summaries in tables that follow, were generated by Bob N6EK. He also make substantive improvements in this chapter and assisted in editing the entire book manuscript.

sometimes stopped working due to a glitch and the operator would solve the problem by disabling the communications. Second, mode changes made on the radio were not detected by the logging program. (We did occasionally operate CW from the SSB tent and vice versa, due both to antenna availability and to operator preference.)

In order to validate the band and mode of all logged contacts, the merged log was reprocessed by a special program written by N6EK to produce a listing of the band and mode changes for each of the stations. These listings were then compared to the paper logs for each station in order to identify potential logging errors. About every other day a band or mode discrepancy was found in the computer logs. We assume that more errors would have occurred if it had not been for the heightened awareness of the need for correct logging caused by the verification process.

Once an actual band or mode logging error had been detected, it had to be fixed on the computer on which the information had been originally logged unless that log happened to have been truncated that day. Otherwise the incorrect information would be reintroduced when the logs were next merged. After correcting the log in question, a copy of the revised log was collected. The revised log also included any additional contacts that had been logged between the time the original log was collected and the time the revised log was collected. The logs were then merged again using the corrected information and the newly merged log was again checked against the paper logs.

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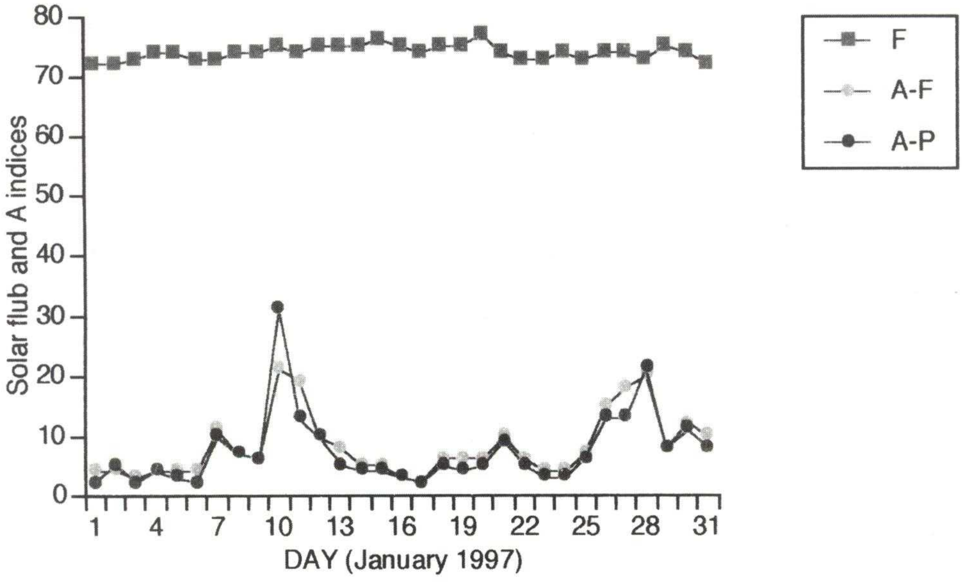
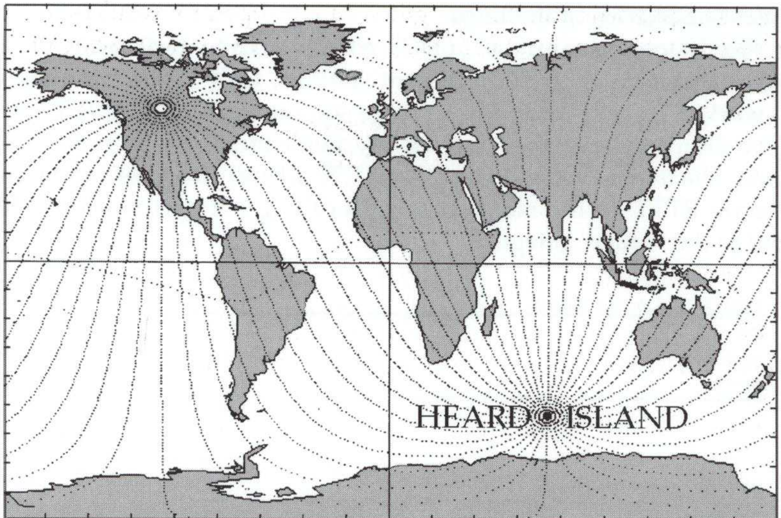
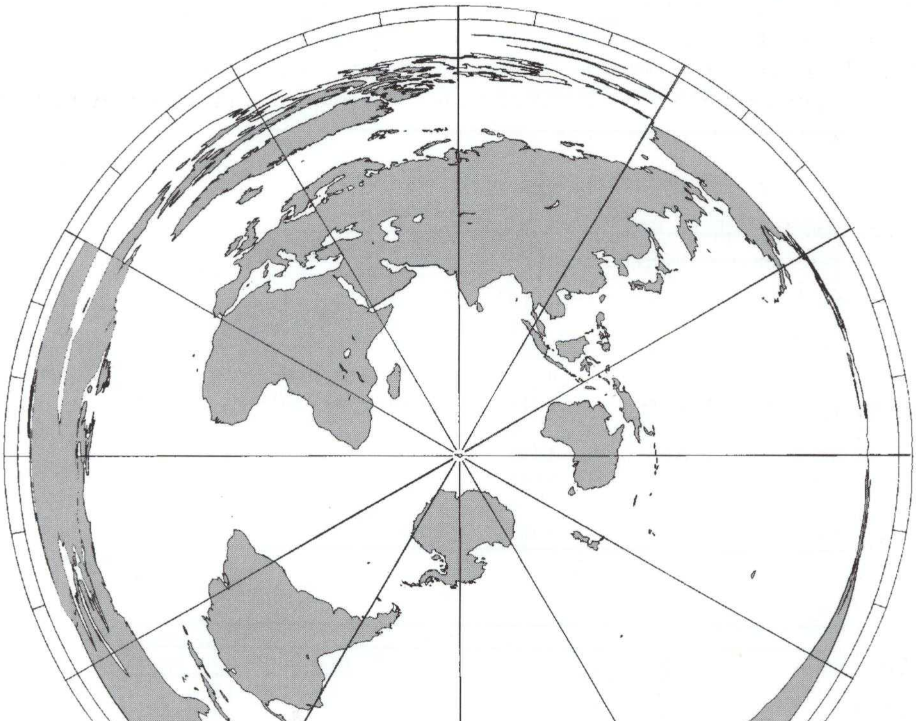
Solar Activity

For reference, we plot the solar flux and A-indices for the month of January, 1997. Clearly VKØIR enjoyed a period of exceptional quiet.





Bipolar world map centered on Heard Island and its antipode near Saskatoon, Canada.



World map centered on Heard Island.

Numerical Summaries of the Logs

The VKØIR logs contain 80,673 QSOs. After removing duplicate contacts, there are 74,433 contacts with 27,500 different stations. Half the stations we worked (13,387) worked us only once. The average station worked VKØIR 2.9 times. Although we didn't work all the zones on any single mode, we worked all zones on *some* mode. We missed zones 10 and 34 on CW, 23 and 40 on SSB, and nine different zones on RTTY. In the tables below, all callsigns logged with a "slash" are assxigned to the "other" category.

VKØIR QSOs vs mode

CW	45536
SSB	33081
RTTY	2056
Total	80673

VKØIR QSOs vs area

Japan	14941
European	35846
Eastern North America	14532
Central North America	5837
Western North America	4157
Australia and New Zealand	713
Other	4647
Total	80673

VKØIR QSOs vs band/mode

Band	CW	SSB	RTTY	Total QSOs
SAT	144	490	0	634
10	110	118	0	228
12	574	174	0	748
15	5362	4456	0	9818
17	5149	4542	0	9691
20	11977	16318	2056	30351
30	7111	0	0	7111
40	11079	4479	0	15558
80	2789	2504	0	5293
160	1241	0	0	1241
Total	45536	33081	2056	80673

VKØIR band zones, DXCC totals

	Zones			*DXCC*		
Band	SSB	CW	RTTY	SSB	CW	RTTY
SAT	16	10		41	18	
10	8	5		10	7	
12	10	11		28	32	
15	32	31		102	99	
17	34	33		115	105	
20	37	37	31	179	139	79
30	-	32		-	99	
40	33	35		105	115	
80	29	26		180	80	
160	-	21		-	66	

Band-mode summaries by region

VKØIR Japanese Contacts:

Mode	SAT	10	12	15	17	20	30	40	80	160	Total
CW	91	79	319	1336	1289	2042	992	1979	662	202	8991
SSB	135	92	61	756	812	2020	0	1078	519	0	5473
RTTY	0	0	0	0	0	477	0	0	0	0	477
Total	226	171	380	2092	2101	4539	992	3057	1181	202	14941

VKØIR European Contacts:

Mode	SAT	10	12	15	17	20	30	40	80	160	Total
CW	46	22	233	2949	3082	5350	3217	4422	1287	750	21358
SSB	298	14	93	2859	2046	5749	0	1764	933	0	13756
RTTY	0	0	0	0	0	732	0	0	0	0	732
Total	344	36	326	5808	5128	11831	3217	6186	2220	750	35846

VKØIR Eastern North American Contacts:

Mode	SAT	10	12	15	17	20	30	40	80	160	Total
CW	3	0	0	516	404	2009	1812	2176	441	194	7555
SSB	18	0	0	389	963	3850	0	845	536	0	6601
RTTY	0	0	0	0	0	376	0	0	0	0	376
Total	21	0	0	905	1367	6235	1812	3021	977	194	14532

VKØIR Central North American Contacts:

Mode	SAT	10	12	15	17	20	30	40	80	160	Total
CW	0	0	0	324	104	1014	570	929	94	15	3050
SSB	0	0	0	173	394	1640	0	229	101	0	2537
RTTY	0	0	0	0	0	250	0	0	0	0	250
Total	0	0	0	497	498	2904	570	1158	195	15	5837

VKØIR Western North American Contacts:

Mode	SAT	10	12	15	17	20	30	40	80	160	Total
CW	1	0	0	14	40	828	230	1093	145	16	2367
SSB	0	0	0	28	51	1143	0	244	202	0	1668
RTTY	0	0	0	0	0	122	0	0	0	0	122
Total	1	0	0	42	91	2093	230	1337	347	16	4157

VKØIR Australian and New Zealand Contacts:

Mode	SAT	10	12	15	17	20	30	40	80	160	Total
CW	1	1	1	15	30	126	32	23	18	6	253
SSB	4	3	1	23	31	325	0	21	39	0	447
RTTY	0	0	0	0	0	13	0	0	0	0	13
Total	5	4	2	38	61	464	32	44	57	6	713

VKØIR Other Contacts:

Mode	SAT	10	12	15	17	20	30	40	80	160	Total
CW	2	8	21	208	200	608	258	457	142	58	1962
SSB	35	9	19	228	245	1591	0	298	174	0	2599
RTTY	0	0	0	0	0	86	0	0	0	0	86
Total	37	17	40	436	445	2285	258	755	316	58	4647

Band-mode Summaries by Region [Contributed by John Devoldere ON4UN]

.VKØIR QSOs with NORTH AMERICA

DXCC	QSO	STNS	RATIO	CW10	SB10	CW12	SB12	CW15	SB15	CW18	SB18	CW20	SB20	CW30	CW40	SB40	CW80	SB80	160	CWST	SBST	(CW	(SB	RTTY
W0	1762	683	2.58	0	0	0	0	103	58	34	105	275	423	203	301	90	33	45	4	0	0	953	721	88
W1	2186	810	2.70	0	0	0	0	59	39	73	146	246	498	274	345	169	99	134	54	0	1	1150	987	49
W2	2711	1052	2.58	0	0	0	0	89	59	85	182	355	678	340	431	163	95	113	40	0	1	1435	1196	80
W3	1763	643	2.74	0	0	0	0	68	54	59	111	228	422	215	289	125	65	56	28	0	2	952	770	41
W4	3726	1508	2.47	0	0	0	0	193	121	94	285	626	986	497	482	171	64	55	15	2	9	1973	1627	126
W5	1575	781	2.02	0	0	0	0	88	32	15	103	353	566	98	205	21	6	8	0	0	0	765	730	80
W6	1820	930	1.96	0	0	0	0	4	8	13	15	447	511	96	476	84	52	42	6	1	0	1095	660	65
W7	1562	724	2.16	0	0	0	0	5	16	18	27	258	398	105	398	114	54	106	8	0	0	846	661	55
W8	2086	814	2.56	0	0	0	0	84	83	56	148	309	531	255	323	119	47	51	20	0	0	1094	932	60
W9	2048	772	2.65	0	0	0	0	123	81	52	155	320	477	230	325	107	50	43	10	0	0	1110	863	75
W TOTAL	*20985*	*8587*	*2.44*	*0*	*0*	*0*	*0*	*808*	*549*	*495*	*1253*	*3382*	*5422*	*2291*	*3520*	*1146*	*561*	*646*	*184*	*3*	*13*	*11244*	*9029*	*712*
KL7	80	31	2.58	0	0	0	0	3	0	3	4	9	18	3	16	6	10	6	0	0	0	44	34	2
VE	1321	550	2.40	0	0	0	0	22	29	30	49	161	373	112	209	115	63	120	17	1	2	615	688	18
KP4	93	42	2.21	0	0	0	0	5	8	2	12	12	29	11	5	6	0	2	0	0	0	35	57	1
XE	55	46	1.20	0	0	0	0	0	0	0	9	3	38	1	2	0	0	0	0	0	0	6	47	2

VKØIR QSOs with SOUTH AMERICA

DXCC	QSO	STNS	RATIO	CW10	SB10	CW12	SB12	CW15	SB15	CW18	SB18	CW20	SB20	CW30	CW40	SB40	CW80	SB80	160	CWST	SBST	(CW	(SB	RTTY
CE	42	34	1.24	0	0	0	0	0	0	1	2	3	35	0	0	0	0	0	0	0	0	4	37	1
CX	37	26	1.42	0	0	0	0	0	1	0	1	3	24	4	0	0	0	0	0	0	0	7	26	4
HK	77	61	1.26	0	0	0	0	1	3	0	1	7	60	2	0	0	0	0	0	0	0	10	64	3
LU	307	225	1.36	0	0	0	0	14	19	4	20	45	186	4	0	7	0	0	0	0	0	67	232	8
PY	366	174	2.10	0	0	0	0	21	15	12	23	51	121	44	33	21	8	9	1	0	1	170	190	6
YV	86	71	1.21	0	0	0	0	0	3	0	1	10	69	0	0	2	0	0	0	0	0	10	75	1
ZP	59	41	1.44	0	0	0	0	0	1	0	9	4	37	2	0	3	0	0	0	0	0	6	50	3

VKØIR QSOs with ASIA

DXCC	QSO	STNS	RATIO	CW10	SB10	CW12	SB12	CW15	SB15	CW18	SB18	CW20	SB20	CW30	CW40	SB40	CW80	SB80	160	CWST	SBST	(CW	(SB	RTTY
4X	141	63	2.24	4	0	3	3	9	19	12	5	18	47	7	7	2	3	1	2	0	0	62	77	2
9K2	59	18	3.28	0	3	3	3	3	6	3	4	4	12	3	1	10	1	4	1	0	0	16	42	1
DU	28	19	1.47	0	0	0	0	1	1	0	1	5	18	1	1	0	0	0	0	0	0	8	20	0
EY	25	6	4.17	0	0	0	0	4	0	4	2	1	3	1	3	4	3	0	0	0	0	16	9	0
HL	105	40	2.63	0	0	0	0	4	0	6	7	18	17	3	15	17	5	11	0	0	1	51	53	1
HS	20	14	1.43	0	0	0	0	1	2	0	0	3	11	0	1	1	0	0	0	0	0	5	14	1
JA0	524	171	3.06	1	0	8	0	42	20	50	28	75	85	40	75	30	23	26	10	2	3	318	192	14
JA1	3904	1191	3.28	14	13	76	13	344	180	354	224	545	592	266	535	290	173	127	46	19	42	2296	1481	127
JA2	2096	566	3.70	16	22	50	12	187	123	183	129	295	269	146	255	129	88	76	30	22	27	1222	787	87
JA3	1590	474	3.35	5	11	33	7	146	84	127	77	232	211	109	225	124	65	47	18	10	14	937	575	78
JA4	1062	279	3.81	6	10	30	5	85	61	90	65	134	143	66	131	81	57	47	25	7	13	601	425	36
JA5	785	205	3.83	11	7	24	7	77	50	63	45	94	93	45	99	55	45	36	19	10	9	463	302	20
JA5	1156	331	3.49	23	22	45	6	107	77	94	64	162	159	93	151	66	48	37	11	3	4	692	435	29
JA7	1212	378	3.21	2	0	10	6	113	55	106	72	170	173	64	173	91	60	59	22	8	8	718	464	30
JA8	981	297	3.30	0	0	2	1	94	37	106	50	115	112	76	155	126	40	38	7	1	1	594	365	22
JA9	494	142	3.48	0	2	11	4	46	34	44	28	63	65	41	61	35	17	15	2	7	10	281	193	20
JA TOTAL	*14013*	*4099*	*3.42*	*78*	*87*	*289*	*61*	*1263*	*736*	*1237*	*794*	*1903*	*1932*	*957*	*1886*	*1047*	*628*	*516*	*193*	*90*	*134*	*8235*	*5307*	*471*
UA0	579	245	2.36	0	0	0	0	41	9	35	7	111	50	46	155	22	45	27	22	1	3	456	118	5
UN	67	29	2.31	0	0	0	0	10	2	4	0	16	7	3	14	1	3	2	4	0	0	54	12	1
VU	25	9	2.78	0	0	0	0	4	2	2	1	5	7	0	3	1	0	0	0	0	0	14	11	0

VKØIR QSOs with EUROPE

DXCC	QSO	STNS	RATIO	CW10	SB10	CW12	SB12	CW15	SB15	CW18	SB18	CW20	SB20	CW30	CW40	SB40	CW80	SB80	160	CWST	SBST	(CW	(SB	RTTY
9A	310	124	2.50	0	0	5	0	28	21	29	11	61	40	11	54	12	15	15	12	0	0	210	99	1
CT	257	126	2.04	0	0	0	2	11	56	11	19	13	100	4	10	9	1	11	1	0	0	51	197	9
DL	5838	1981	2.95	0	0	49	4	473	371	697	378	865	712	712	663	230	212	118	134	20	100	3776	1913	149
EA	1654	658	2.51	0	0	0	2	131	270	85	114	191	461	70	89	118	17	56	4	0	1	587	1022	45
EI	59	26	2.27	0	0	0	0	2	5	3	7	6	13	4	5	3	5	5	1	0	0	26	33	0
ER	30	12	2.50	0	0	0	0	0	0	2	0	2	7	2	8	1	6	0	2	0	0	22	8	0
EU	39	18	2.17	0	0	0	0	3	0	4	1	9	1	3	14	0	4	0	0	0	0	37	2	0
F	1421	538	2.64	0	0	13	9	108	146	113	123	195	301	119	102	82	26	25	14	1	20	678	706	37
G	1672	650	2.57	0	0	5	2	92	80	176	127	252	303	195	180	82	69	37	39	0	8	1003	639	30
HA	740	238	3.11	0	0	4	0	96	48	73	20	141	69	67	139	25	40	7	11	0	0	567	169	4
HB	788	306	2.58	0	0	0	0	52	39	67	34	138	183	67	91	27	25	15	24	0	13	464	311	13
I	5103	1819	2.81	3	14	19	21	347	683	280	439	537	1152	291	340	459	80	168	50	4	42	1932	2978	193
LA	773	253	3.06	0	0	1	2	80	46	74	26	114	89	76	130	19	49	26	23	0	0	546	208	19
LX	44	18	2.44	0	0	0	0	2	2	5	4	3	12	4	4	2	0	2	1	0	2	19	24	1
LY	99	41	2.41	0	0	0	0	7	2	6	0	26	9	13	22	1	6	3	3	0	1	83	16	0
LZ	178	76	2.34	0	0	0	0	13	8	20	10	28	25	17	35	9	5	4	1	1	1	120	57	1
OE	527	227	2.32	0	0	6	0	30	48	41	44	71	138	39	53	16	13	10	6	1	9	254	265	8
OH	2030	552	3.68	18	0	34	26	255	187	166	78	331	235	147	241	79	108	61	70	0	1	1336	667	27
OK	1133	386	2.94	0	0	6	0	104	31	142	57	206	102	173	193	34	39	16	19	0	4	876	244	13
OM	466	141	3.30	0	0	9	4	42	17	57	6	86	39	61	71	7	29	15	26	0	0	372	88	6
ON	975	276	3.53	0	0	12	1	72	81	96	95	116	185	91	80	47	38	28	19	1	5	513	442	20
OY	43	10	4.30	0	0	0	0	4	3	2	3	3	4	3	4	2	3	3	6	0	0	25	15	3
OZ	656	187	3.51	0	0	24	8	64	65	64	53	80	88	48	65	34	25	16	24	1	7	371	271	14
PA	611	215	2.84	0	0	6	0	44	48	67	48	86	77	72	59	33	21	16	12	2	11	363	233	15
S5	444	181	2.45	0	0	0	0	34	16	43	9	84	42	48	97	8	12	28	11	1	3	330	106	8
SM	1438	458	3.14	0	0	17	7	168	95	109	45	253	164	103	224	52	83	42	47	0	6	987	411	40
SP	2019	668	3.02	0	0	5	1	180	136	206	91	313	185	257	359	98	104	46	25	1	5	1445	562	12
SV	169	73	2.32	0	0	0	0	5	29	6	15	18	27	8	21	12	1	8	13	0	5	72	96	1
T7	23	8	2.88	0	0	1	1	2	3	0	2	1	5	1	4	1	1	0	1	0	1	10	13	0
T9	20	10	2.00	0	0	0	0	2	1	0	0	7	2	1	4	1	1	1	0	0	0	15	5	0
TA	37	13	2.85	0	0	0	0	2	1	3	3	4	12	2	4	1	2	0	2	0	0	19	17	1
UA	1399	608	2.30	0	0	0	0	124	68	87	29	257	190	121	296	77	44	37	36	9	10	974	411	14
UA2	38	15	2.53	0	0	0	0	10	1	0	0	5	0	0	10	1	3	1	7	0	0	35	3	0
UR	256	102	2.51	0	0	2	1	29	14	19	4	59	32	16	47	16	9	5	5	0	0	184	72	0
YL	83	27	3.07	0	0	0	0	8	2	7	3	8	4	7	17	4	9	1	7	0	1	63	15	5
YO	175	94	1.86	0	0	0	0	20	7	15	4	34	21	14	32	10	9	1	3	2	2	129	45	1
YU	309	165	1.87	0	0	0	0	25	14	9	1	80	34	13	72	4	27	19	3	0	0	229	72	8

VKØIR QSOs with OCEANIA

DXCC	QSO	STNS	RATIO	CW10	SB10	CW12	SB12	CW15	SB15	CW18	SB18	CW20	SB20	CW30	CW40	SB40	CW80	SB80	160	CWST	SBST	(CW	(SB	RTTY
KH6	22	16	1.38	0	0	0	0	0	0	0	0	8	11	0	2	1	0	0	0	0	0	10	12	0
VK	480	268	1.79	1	3	1	1	12	23	24	24	74	200	26	16	18	10	30	6	1	3	170	302	8
ZL	141	93	1.52	0	0	0	0	0	0	4	5	34	75	4	4	1	3	5	0	0	1	49	87	5

VKØIR QSOs with AFRICA

DXCC	QSO	STNS	RATIO	CW10	SB10	CW12	SB12	CW15	SB15	CW18	SB18	CW20	SB20	CW30	CW40	SB40	CW80	SB80	160	CWST	SBST	(CW	(SB	RTTY
FR	42	12	3.50	0	0	0	0	2	3	3	3	4	8	2	2	5	2	3	2	0	2	17	24	1
ZS	308	139	2.22	0	0	1	0	10	22	12	26	28	114	13	11	34	10	19	4	0	1	88	216	4

Note: In these tables, only DXCC countries with more than 20 QSOs are listed.

Activity vs Day

The table below lists the daily counts for VKØIR. There are two sets of data:

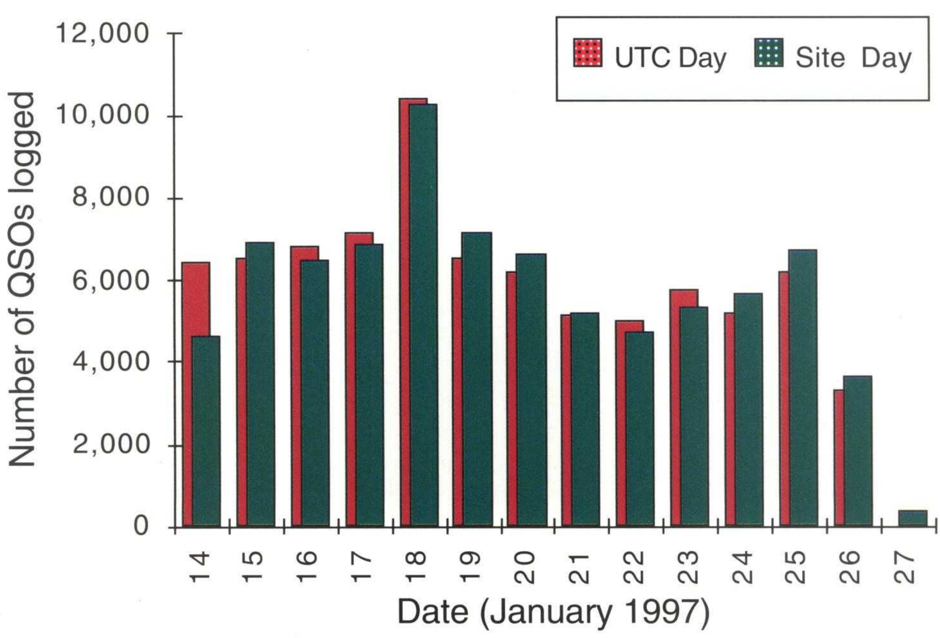
(1) UTC Date: Defined as 0000—>2359 UTC for each date.

(2) Site Day: The logs were collected and processed in the morning of each day, typically around 1100 AM local, or about 0600 UTC. These were the daily summaries that we used during the expedition to mark our progress. The "Site day" is therefore defined as the times the logs were collected, which varied slightly from day to day. Surprisingly, the number of QSOs logged on UTC days and Site days are not very different.

The overall average rate of logging for the 80,673 QSOs in 13 days of operation was 4.3 /min.

VKØIR Daily QSO counts

UTC Date	New QSOs	Total QSOs	Site Day	New QSOs	Total QSOs	New Calls	Total Calls
Jan. 14	4,649	4,649	1	6,455	6,455	4,118	4,118
Jan. 15	6,924	11,573	2	6,509	12,964	2,940	7,058
Jan. 16	6,500	18,073	3	6,819	19,783	2,645	9,703
Jan. 17	6,850	24,923	4	7,138	26,921	2,509	12,212
Jan. 18	10,250	35,173	5	10,398	37,319	3,006	15,218
Jan. 19	7,153	42,326	6	6,517	43,836	1,831	17,049
Jan. 20	6,638	48,964	7	6,181	50,017	1,764	18,813
Jan. 21	5,227	54,191	8	5,158	55,175	1,594	20,407
Jan. 22	4,735	58,926	9	5,014	60,189	1,341	21,748
Jan. 23	5,332	64,258	10	5,792	65,981	1,773	23,521
Jan. 24	5,696	69,954	11	5,203	71,184	1,350	24,871
Jan. 25	6,728	76,682	12	6,187	77,371	1,712	26,583
Jan. 26	3,620	80,302	13	3,302	80,673	917	27,500
Jan. 27	371	80,673					



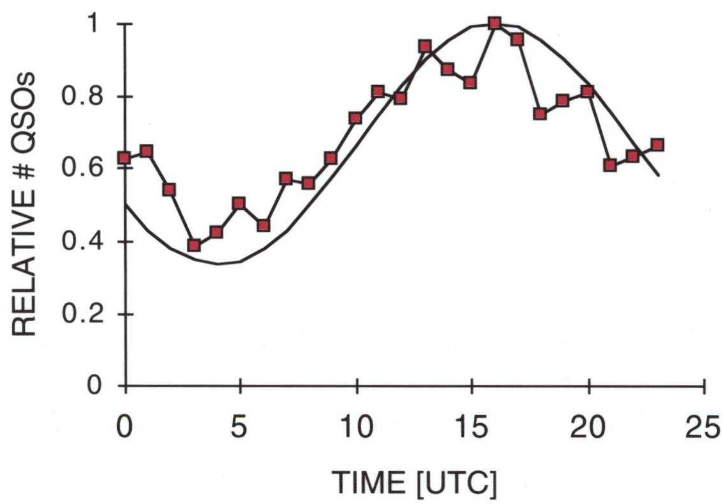
Activity vs Time of Day

In previous expeditions (3YØPI, XRØY), we have noted the very simple (ca sinusoidal) dependence of the QSO rate on time of day. We see this simple dependence again in the VKØIR logs, although the phase of the sinusoid is shifted here. The following table gives the total number of QSOs logged for each hour (beginning at the listed time), and the plot shows these data normalized to unity and with a fitted sinusoid. The curve is the astonishingly simple relationship

$$f(t) = (1/3)[2+\cos(2\pi(t+8)/24)]$$

which is precisely the same function found for 3YØPI (with an 8-hour shift).

(Time (UTC)	Total QSOs
0000	3,055
0100	3,141
0200	2,642
0300	1,888
0400	2,074
0500	2,452
0600	2,154
0700	2,789
0800	2,720
0900	3,047
1000	3,617
1100	3,968
1200	3,885
1300	4,560
1400	4,280
1500	4,090
1600	4,884
1700	4,675
1800	3,648
1900	3,839
2000	3,972
2100	2,972
2200	3,081
2300	3,240
Total	80,673



Propagation Charts

The next five pages present the detailed propagation tables: total QSOs logged by VKØIR every 30-minute interval on each band. Calls with a slash or stroke in them are not included in these tables. In addition, the tables assume that US stations are operating from the area indicated by their call, a source of spurious counts, especially for Western North America.

On Heard Island, we developed these tables cumulatively, day by day. These data were compared with the predicted band openings in side-by-side charts, and used to set strategy for the next day's operations.

Summary of Japanese Contacts by Half Hour:

hour	10	12	15	17	20	30	40	80	160
0000Z	0	0	0	0	0	0	0	0	0
0030Z	0	0	0	1	2	0	0	0	0
0100Z	0	0	0	20	2	0	0	0	0
0130Z	0	0	0	4	4	0	0	0	0
0200Z	0	0	6	0	2	0	0	0	0
0230Z	0	0	17	0	31	0	0	0	0
0300Z	0	0	17	8	33	0	0	0	0
0330Z	0	0	13	62	9	0	0	0	0
0400Z	0	0	88	107	31	2	0	0	0
0430Z	0	0	126	175	128	1	0	0	0
0500Z	0	53	167	244	226	0	0	0	0
0530Z	60	106	225	203	215	0	0	0	0
0600Z	51	31	232	181	214	0	0	0	0
0630Z	43	34	261	250	212	0	0	0	0
0700Z	15	37	285	358	289	0	0	0	0
0730Z	1	59	258	283	286	0	0	0	0
0800Z	0	30	202	68	268	0	0	0	0
0830Z	1	30	126	43	301	0	0	0	0
0900Z	0	0	34	66	280	0	0	0	0
0930Z	0	0	25	15	200	0	0	0	0
1000Z	0	0	2	0	180	1	0	0	0
1030Z	0	0	0	0	142	18	0	0	0
1100Z	0	0	0	4	321	93	0	0	0
1130Z	0	0	1	2	330	92	4	0	0
1200Z	0	0	1	4	344	103	111	0	0
1230Z	0	0	4	0	271	171	247	0	0
1300Z	0	0	0	0	125	126	231	0	0
1330Z	0	0	1	0	40	123	217	0	0
1400Z	0	0	0	0	44	96	133	6	0
1430Z	0	0	0	0	4	48	245	19	0
1500Z	0	0	0	0	0	13	105	4	0
1530Z	0	0	0	0	0	5	193	13	0
1600Z	0	0	0	0	0	0	107	61	1
1630Z	0	0	0	0	0	0	204	88	1
1700Z	0	0	0	0	0	3	248	82	0
1730Z	0	0	0	0	0	22	174	53	2
1800Z	0	0	0	0	1	26	147	84	7
1830Z	0	0	0	0	0	16	144	116	70
1900Z	0	0	0	0	0	2	187	104	29
1930Z	0	0	0	0	0	1	74	130	0
2000Z	0	0	0	0	0	0	34	153	0
2030Z	0	0	0	0	0	0	31	123	1
2100Z	0	0	0	0	0	0	67	99	51
2130Z	0	0	0	0	0	0	79	45	38
2200Z	0	0	0	0	2	17	70	1	2
2230Z	0	0	0	0	1	13	5	0	0
2300Z	0	0	1	3	1	0	0	0	0
2330Z	0	0	0	0	0	0	0	0	0

Summary of European Contacts by Half Hour:

hour	10	12	15	17	20	30	40	80	160
0000Z	0	0	0	0	0	39	179	56	0
0030Z	0	0	0	0	0	51	171	13	0
0100Z	0	0	0	0	0	52	110	0	0
0130Z	0	0	0	0	0	18	42	0	0
0200Z	0	0	0	0	1	2	3	0	0
0230Z	0	0	0	0	1	1	2	0	0
0300Z	0	0	0	0	3	0	0	0	0
0330Z	0	0	0	0	3	0	0	0	0
0400Z	0	0	0	1	0	0	0	0	0
0430Z	0	0	0	0	2	0	0	0	0
0500Z	0	0	0	1	7	0	0	0	0
0530Z	0	0	1	0	19	0	0	0	0
0600Z	0	0	1	7	61	0	0	0	0
0630Z	0	0	16	17	90	0	0	0	0
0700Z	0	0	40	38	138	0	0	0	0
0730Z	0	0	92	76	207	0	0	0	0
0800Z	0	2	120	149	282	0	0	0	0
0830Z	0	1	332	182	287	0	0	0	0
0900Z	0	0	418	229	272	0	0	0	0
0930Z	0	7	505	426	330	0	0	0	0
1000Z	0	13	548	475	413	0	0	0	0
1030Z	0	1	538	486	529	0	0	0	0
1100Z	3	45	582	419	467	0	0	0	0
1130Z	19	17	475	356	343	0	0	0	0
1200Z	0	36	317	330	253	0	0	0	0
1230Z	0	58	385	314	333	0	0	0	0
1300Z	1	63	312	360	481	0	0	0	0
1330Z	0	52	324	354	782	0	0	0	0
1400Z	0	31	208	344	777	3	2	0	0
1430Z	13	0	224	249	752	33	2	0	0
1500Z	0	0	255	138	744	49	5	0	0
1530Z	0	0	82	92	938	110	36	0	2
1600Z	0	0	32	41	987	354	129	21	21
1630Z	0	0	1	26	716	286	348	35	7
1700Z	0	0	0	6	616	360	359	72	0
1730Z	0	0	0	12	454	320	340	99	0
1800Z	0	0	0	0	151	158	254	126	30
1830Z	0	0	0	0	132	191	378	173	24
1900Z	0	0	0	0	142	222	389	226	58
1930Z	0	0	0	0	63	211	462	208	107
2000Z	0	0	0	0	39	192	574	203	105
2030Z	0	0	0	0	13	163	510	201	119
2100Z	0	0	0	0	2	88	319	162	58
2130Z	0	0	0	0	1	65	349	145	84
2200Z	0	0	0	0	0	78	294	115	55
2230Z	0	0	0	0	0	68	272	88	27
2300Z	0	0	0	0	0	57	334	131	36
2330Z	0	0	0	0	0	46	323	146	17

Summary of Eastern North American Contacts by Half Hour:

hour	10	12	15	17	20	30	40	80	160
0000Z	0	0	0	1	96	104	279	102	0
0030Z	0	0	0	0	95	159	406	33	0
0100Z	0	0	0	0	118	205	495	0	0
0130Z	0	0	0	0	140	277	510	0	0
0200Z	0	0	0	0	234	283	411	0	0
0230Z	0	0	0	0	343	239	186	0	0
0300Z	0	0	0	0	362	140	26	0	0
0330Z	0	0	0	0	439	101	11	0	0
0400Z	0	0	0	0	371	60	0	0	0
0430Z	0	0	0	0	307	12	0	0	0
0500Z	0	0	0	0	158	7	0	0	0
0530Z	0	0	0	0	52	0	0	0	0
0600Z	0	0	0	0	10	0	0	0	0
0630Z	0	0	0	0	5	0	0	0	0
0700Z	0	0	0	1	4	0	0	0	0
0730Z	0	0	0	0	2	0	0	0	0
0800Z	0	0	0	0	0	0	0	0	0
0830Z	0	0	0	0	1	0	0	0	0
0900Z	0	0	0	0	0	0	0	0	0
0930Z	0	0	0	0	0	0	0	0	0
1000Z	0	0	0	0	0	0	0	0	0
1030Z	0	0	0	0	0	0	0	0	0
1100Z	0	0	0	1	2	0	0	0	0
1130Z	0	0	0	2	20	0	0	0	0
1200Z	0	0	0	0	63	0	0	0	0
1230Z	0	0	0	13	97	1	20	0	0
1300Z	0	0	0	4	78	7	98	0	0
1330Z	0	0	0	13	93	6	77	0	0
1400Z	0	0	0	61	108	5	54	0	0
1430Z	0	0	3	41	61	2	10	1	0
1500Z	0	0	45	56	14	11	16	1	0
1530Z	0	0	47	89	26	4	8	2	2
1600Z	0	0	52	82	7	4	6	3	0
1630Z	0	0	70	68	7	1	2	0	0
1700Z	0	0	109	92	7	0	0	0	0
1730Z	0	0	114	78	40	0	1	0	0
1800Z	0	0	51	118	100	0	0	0	0
1830Z	0	0	61	98	237	2	0	0	0
1900Z	0	0	49	91	174	1	0	0	0
1930Z	0	0	70	104	228	1	0	0	0
2000Z	0	0	66	78	348	9	1	1	0
2030Z	0	0	64	74	413	11	7	1	0
2100Z	0	0	40	90	316	4	8	16	0
2130Z	0	0	34	33	287	3	6	100	1
2200Z	0	0	10	41	267	14	36	242	38
2230Z	0	0	12	26	183	23	56	222	86
2300Z	0	0	8	8	166	31	96	153	46
2330Z	0	0	0	4	156	85	195	100	21

Summary of Central North American Contacts by Half Hour:

hour	10	12	15	17	20	30	40	80	160
0000Z	0	0	0	1	261	37	73	12	0
0030Z	0	0	0	0	169	27	131	5	0
0100Z	0	0	0	0	96	46	114	0	0
0130Z	0	0	0	0	94	83	135	0	0
0200Z	0	0	0	0	121	69	106	0	0
0230Z	0	0	0	0	119	91	33	0	0
0300Z	0	0	0	0	117	48	6	0	0
0330Z	0	0	0	0	205	28	2	0	0
0400Z	0	0	0	1	188	16	0	0	0
0430Z	0	0	0	0	198	12	0	0	0
0500Z	0	0	0	0	153	3	0	0	0
0530Z	0	0	0	1	74	0	0	0	0
0600Z	0	0	0	0	32	0	0	0	0
0630Z	0	0	0	0	13	0	0	0	0
0700Z	0	0	0	2	12	0	0	0	0
0730Z	0	0	0	0	4	0	0	0	0
0800Z	0	0	0	0	0	0	0	0	0
0830Z	0	0	0	0	0	0	0	0	0
0900Z	0	0	0	0	0	0	0	0	0
0930Z	0	0	1	0	1	0	0	0	0
1000Z	0	0	0	0	3	0	0	0	0
1030Z	0	0	0	0	1	0	0	0	0
1100Z	0	0	1	0	1	0	0	0	0
1130Z	0	0	0	0	0	0	0	0	0
1200Z	0	0	0	0	2	1	1	0	0
1230Z	0	0	0	0	14	0	5	0	0
1300Z	0	0	0	1	6	0	30	0	0
1330Z	0	0	0	1	39	0	155	0	0
1400Z	0	0	0	5	12	8	159	0	0
1430Z	0	0	0	18	9	8	63	7	0
1500Z	0	0	12	38	5	8	20	3	0
1530Z	0	0	25	17	7	19	18	3	0
1600Z	0	0	34	30	3	3	7	1	0
1630Z	0	0	42	42	3	0	3	0	0
1700Z	0	0	24	14	8	0	0	0	0
1730Z	0	0	27	25	7	1	0	0	0
1800Z	0	0	37	6	11	0	0	0	0
1830Z	0	0	49	27	9	1	0	0	0
1900Z	0	0	28	21	9	0	0	0	0
1930Z	0	0	34	17	8	0	0	0	0
2000Z	0	0	28	19	9	0	0	0	0
2030Z	0	0	18	27	24	0	1	0	0
2100Z	0	0	12	35	35	0	0	0	0
2130Z	0	0	13	24	65	0	0	1	0
2200Z	0	0	33	33	118	3	1	6	0
2230Z	0	0	33	46	139	17	11	31	3
2300Z	0	0	40	31	241	12	27	72	6
2330Z	0	0	6	16	259	29	57	54	6

Summary of Western North American Contacts by Half Hour:

hour	10	12	15	17	20	30	40	80	160
0000Z	0	0	0	0	27	13	44	3	0
0030Z	0	0	0	0	35	49	110	0	0
0100Z	0	0	0	0	27	37	115	0	0
0130Z	0	0	0	0	13	28	78	0	0
0200Z	0	0	0	0	11	14	37	0	0
0230Z	0	0	0	0	29	9	3	0	0
0300Z	0	0	0	0	56	4	0	0	0
0330Z	0	0	0	0	55	3	0	0	0
0400Z	0	0	0	0	41	1	0	0	0
0430Z	0	0	0	0	52	0	0	0	0
0500Z	0	0	0	0	123	0	0	0	0
0530Z	0	0	0	0	180	0	0	0	0
0600Z	0	0	0	0	109	0	0	0	0
0630Z	0	0	0	0	81	0	0	0	0
0700Z	0	0	0	0	27	0	0	0	0
0730Z	0	0	0	0	15	0	0	0	0
0800Z	0	0	0	0	1	0	0	0	0
0830Z	0	0	0	0	7	0	0	0	0
0900Z	0	0	1	0	2	0	0	0	0
0930Z	0	0	0	0	0	0	0	0	0
1000Z	0	0	0	0	0	1	0	0	0
1030Z	0	0	0	0	1	0	0	0	0
1100Z	0	0	0	0	0	1	0	0	0
1130Z	0	0	0	0	2	1	0	0	0
1200Z	0	0	0	0	4	1	0	0	0
1230Z	0	0	0	0	3	0	9	0	0
1300Z	0	0	0	0	1	2	19	0	0
1330Z	0	0	0	0	7	7	39	0	0
1400Z	0	0	0	0	1	7	78	0	0
1430Z	0	0	0	1	2	3	93	28	0
1500Z	0	0	0	0	1	20	146	64	5
1530Z	0	0	7	4	27	8	226	128	11
1600Z	0	0	14	9	67	3	210	93	0
1630Z	0	0	6	12	182	4	84	3	0
1700Z	0	0	2	14	233	0	13	1	0
1730Z	0	0	1	26	281	0	1	2	0
1800Z	0	0	0	0	141	0	5	1	0
1830Z	0	0	0	4	76	0	1	5	0
1900Z	0	0	2	3	45	0	0	1	0
1930Z	0	0	0	0	25	0	2	0	0
2000Z	0	0	3	1	13	1	0	0	0
2030Z	0	0	1	3	18	0	2	0	0
2100Z	0	0	0	0	5	2	0	0	0
2130Z	0	0	2	4	13	0	0	0	0
2200Z	0	0	2	0	3	2	1	2	0
2230Z	0	0	0	4	17	1	0	3	0
2300Z	0	0	1	4	17	6	3	5	0
2330Z	0	0	0	2	17	2	18	8	0

[continued from p. 150]

The daily validation of band and mode seems to have been a great success. As this is being written, some two months after the close of operations, not a single band or mode logging error has been reported by anyone who has checked the bands and modes of their contacts using the various servers that are available. Of course, there are the inevitable busted calls in the log and plenty of cases where someone thought they had a good contact but it was not in the log.

The validated log was then processed by another special program written by N6EK to get the data ready to be sent via satellite to ON4UN for distribution. The logs were reduced to band, mode and callsign for each contact. Duplicate contacts were removed. Then all band, mode and callsign combinations which had previously been reported to ON4UN were removed. The results were sorted by band and mode and a text file containing the new callsigns for each band and mode was produced. This file was then compressed using PKZIP and sent to ON4UN by amateur satellite by PA3DUU. Once ON4UN received the new contact data, he used another N6EK program to combine the new data with the old data and produce a list of all the callsign, band and mode combinations that were in the log to date. This database was then installed in the various servers which people who contacted us could use to verify that their contact was in the log.

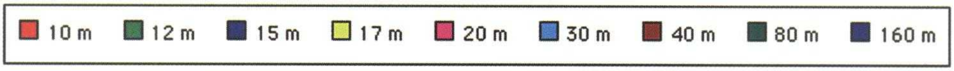
Once the log data was ready to be uploaded to the satellite, a number of summaries were produced which helped ON6TT plan the next day's operating strategy. ON6TT's operating plan concentrated on the three large bodies of hams: Europe, Japan and North America. Because North America was at the antipode of Heard Island and different parts had very different propagation, it was further broken into Eastern North America, Central North America and Western North America. Each day another N6EK program produced a summary of the total contacts to date for each of these five areas by band and mode. This allowed ON6TT to figure out which areas had not received appropriate attention on certain band modes so that he could focus on them the next day.

Another N6EK program was used to count the contacts made with each of the five areas on each band in each thirty minute period of the day. This information supplemented the propagation predictions that had been made in advance and was very helpful for planning what bands to be on at various times of the day.

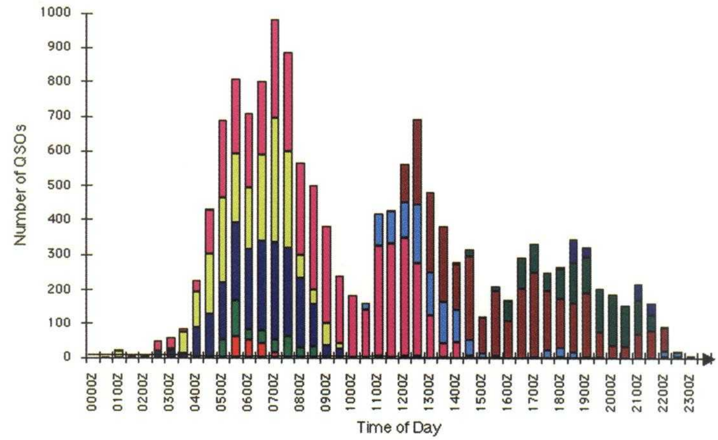
The daily processing of the logs took four to six hours. In the beginning, it included time to write or refine the programs that were used to produce the daily reports. In the end, the programs didn't evolve, but the shear volume of contacts meant that each step took a long time.

Propagation Histograms

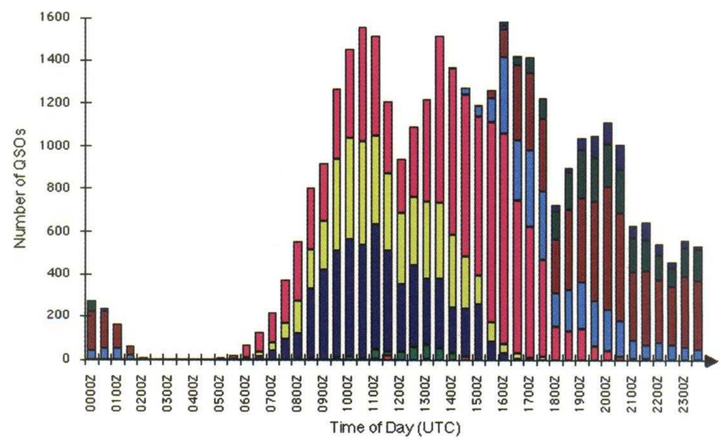
These stack histograms show the data in the propagation tables. In these plots the UTC time increases from 0000 to 2359 from left to right. The total activity as a function of time appears as the envelope of these histograms.



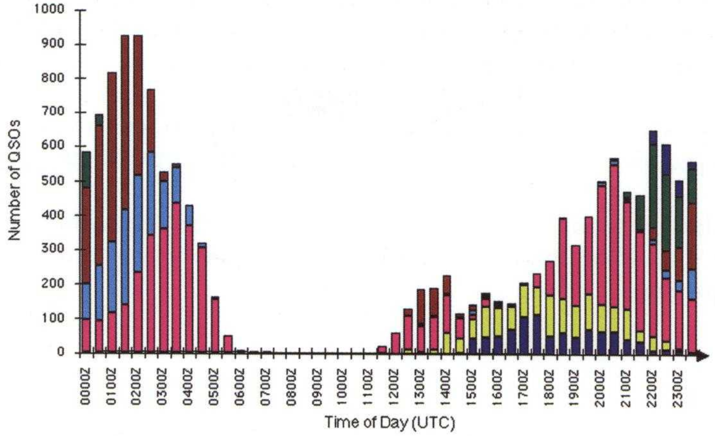
VKØIR to Japan



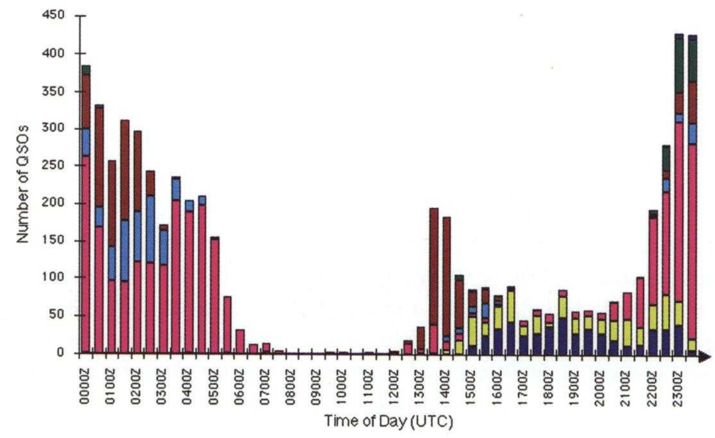
VKØIR to Europe



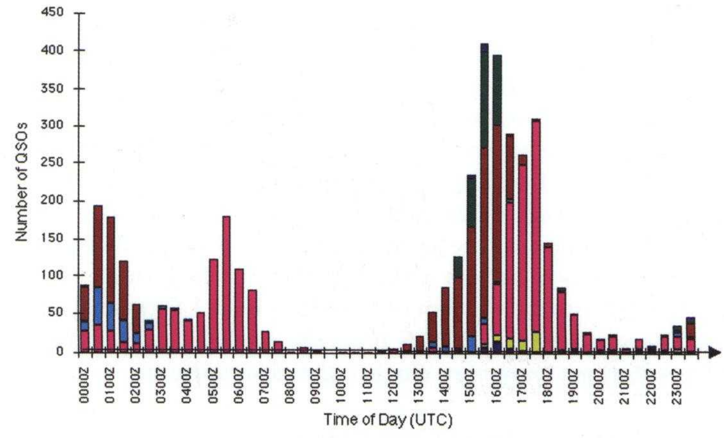
VKØIR to Eastern North America



VKØIR to Central North America



VKØIR to Western North America



Propagation Predictions versus Observations*

Before the expedition, we made extensive propagation forecasts based on several programs: Miniprop Plus, PP and Miniftz. These were displayed on a large sheet in the main communications tent. They were presented as a graph for each area and band, showing when to expect propagation as a function of time. A second sheet was displayed next to that with our observations, based on the daily analysis of our own logs, beacon reports and feedback from the audience through the pilots.

How did our predictions match or differ from the observations? In the tables below, the "predicted" times represent "possible" openings and not "daily guaranteed" openings.

Japan

	predicted	observed
10m:	SP: 2-10	4:30-6:30+8:30
12m:	SP: 01-10:45	5-9
15m:	SP: 01-10	2-13:30
17m:	SP: 23:30-12:30	00:30-2+3-13:30
20m:	SP: 22:30-13	00:45-15:45
30m:	SP: 21-18	10-16+17-19+21-22
40m:	SP: 09-01	12-23 (peak: 17:30)
80m:	SP: 11:30-22:30	15-23
160m:	SP: 15:30-21:45	16-16:30+17:30-19:30+21-22:30

The predictions were reasonably close. Generally, the openings were shorter on some bands, and slightly shifted on others. 10 and 12m opened regularly in the middle of the predicted opening. 15m was open almost daily, and stayed open much longer than predicted. 17m shifted later almost exactly one hour. 30m was the surprise it often is: it is a band having characteristics of both a higher and lower band, so both the LUF and MUF are play an important role. The 'hole' between 18 and 21 was well predicted. 40m seemed to have opened up much later, and closed earlier. I think this is a bit artificial, as from 9-12, we were more often working the piles on the higher bands than on 40, and after 23, we often shifted to EU. My guess is that propagation might have been there. The later opening on 80m is the same thing, though it might not have opened as early as the predicted 11:30, the propagation might have been there a bit earlier than we took advantage of. 160m was almost as predicted, with a shift to 30-45 minutes later. What surprised me most was the unstable propagation to JA on the higher bands in the morning. Regularly, we had 20m opening up, as predicted, followed by the higher bands, in sequence, but often 20m and 17m kept quiet, showing that the LUF probably was too high, since on the same days the higher bands opened up as predicted. In general, since JA was a slightly skewed path from north/south, (NE beam heading), the typical rhythm of the MUF and LUF cycle is very obvious on our graphs. The more the path is N-S, the more explicit this is, and the easier it is to predict. JA predictions were very close to the observations.

*Contributed by Peter Casier ON6TT. Edited by N6EK and KK6EK.

Europe

	predicted	observed
10m:	SP 9-13	11-13:30+14:30-15
12m:	SP 8-14	8-13:30
15m:	SP 7:15-15	6:30-15:30
17m:	SP 7-15:30	6-18
20m:	SP 5-17	4:30-22
30m:	SP: 6:15-18	14-03
40m:	SP: 14:15-3:30	14-03
80m:	SP: 16:15-03	15-01
160m:	SP: 19-01	15:30-17+18-01

As EU was the continent which came the closest to the N-S path, we had high hopes for regular openings on 10-12m. Unfortunately, that was not to be the case. Scandinavia and southern Europe were clearly favored, with a one time surprising opening 14:30-15 on 10m, which might have been exceptional TEP (transequatorial propagation). 15m behaved almost exactly as predicted while 17m openings were much longer than predicted. 20m was a bit of a surprise, as openings were up to 5 hours longer than predicted. 30m was a complete surprise (as that band often is, hi!). We predicted 30m to behave like a 'higher' band, much MUF driven, but it behaved completely the opposite: it behaved like a low band, i.e. LUF driven. So instead of showing similar openings similar to 20m (as predicted), it behaved like 40m. 40m predictions and observations were almost equal. 80m opened up earlier, and closed earlier. 160m was a surprise, as it opened much earlier. This might have been caused by incorrect propagation modeling, as the 160m antenna was very close to the salt water, ensuring a very low angle of radiation, much lower than the one used for the propagation predictions. That could explain why the openings occurred 3.5 hours earlier than predicted. Ground conductivity at the antenna is very important on 160m. In general: Europe was the continent which came the closest to the N/S path, and, except for 30m, propagation behaved very close to that predicted. Graphically represented, the LUF/MUF cycle is very clear and almost a classic example. The explanation is very easy: the more N/S a path, the more the LUF/MUF cycle concurs between both locations.

Eastern North America

	predicted	observed
10m:	SP:11:30-18 (10%chance)	none
12m:	SP:11-18 (10% chance)	none
15m:	SP:11-18:30	14:30-23:30
17m:	SP:10:30-21	11-00
20m:	SP:11:30-21:30	11-8:30 (peak 02-04)
30m:	SP:15-23+03:30-6:30 LP:12-16	12:30-17+17:30-7
40m:	SP:18-07 LP:9-17 (low probability)	12:30-04
80m:	SP: 20-4:30 LP: 10-15:30	19:30-01 14:30-15:30
160m:	SP: 22-23:00	21:30-00+15:30

Here we start with the paths that are significantly skewed from north/south: East Coast beam headings were 210 to 300 degrees. This makes it more difficult to predict propagation and sporadic openings might start to appear. Unfortunately, no 10m and 12m openings occurred. I seriously doubt whether the MUF ever went that high. We had some people reporting our beacon, but I think that was either a pirate, or they confused another NCDXF beacon with ours. Even during the first Saturday, when we had a massive 15m opening to the whole of North America, we called and called on 12m and 10m, but heard nothing. That makes me feel comfortable that there was no 10/12m opening that we missed. I lost my bet that we would work every continent on 10m! 15m openings to the East Coast were very sporadic, and once it opened up, the propagation could remain much later than expected. Most of the 15m openings to East Coast were during that famous opening during the first Saturday. Signals were very very strong then. Also 17m remained open longer than expected. 20m was our biggest surprise. It opened up as expected but often stayed open until noon local time on Heard. That made a lot of people happy, but was not predicted. 30m behaved almost as predicted, except that the switch from LP to SP (and the concurring blackout) between 23 and 3:30 was not there, and propagation remained. This means that the LUF stayed lower than predicted. 40m: A pity I do not have LP/SP records on this. Clearly during the switch from LP to SP, the signals were much weaker, but they were there. In general, the band opened up a bit later, and closed earlier. This might show the LUF getting higher than predicted, but that is a contradiction to the 30m behavior. 80m: closed earlier than expected on SP, and the LP opening started later. When we had openings, the signals were much stronger than expected. 160m: a nice surprise. Opened up earlier and closed later than expected, signals were often much stronger than predicted. Once again, with the 160m vertical so close to the salt water, the low radiation angle accounts for that. A surprise was that we could take advantage of the occasional LP opening around 15:30. In general: East-Coast propagation was better than expected, with much stronger signals on the lower bands. The LUF/MUF cycle is still visible, but clearly, the low MUF and the skewed path made it impossible for 10-12.

Central North America

	predicted	observed
10m:	14:15-21 (10% chance)	none
12m:	SP: 14-01 (low chance)	none
15m:	SP: 14-00:15	15-00
17m:	SP: 13-01:30	13-00 (LP:14-15)
		weak: 04+07:30+9:30-
10:30		
20m:	SP:12-04+07-11:30	9:30-8:30 (LP+SP@17)
		(peak: 2+4)
30m:	SP: 23-11	14:30-17 (LP?)+20:30-
5		
	LP: 00-02+13-23(?)	
40m:	SP: 23:45-11:45	SP:20:30-04
	LP: 11:45-02(?)	LP:12-18
80m:	LP:12:30-18(?)	LP:14:30-15:30
	SP: 21-01	SP:21:30-01
160m:	LP: 23 (improbable)	21:45-00

This path is far away from the north/south path (beam heading 180 to 240) and was difficult to predict. 10/12m showed no opening, not even during the first Saturday, when the Midwest came booming in on 15m. The MUF simply did not go that high. 15m opened up a bit later, but behaved as predicted, except on the first Saturday, when Midwest had the strongest signals on the band. 17m was close to the predictions, though it closed earlier than predicted. On the other hand, we had sporadic weak openings at non-predicted times. 20m was a shock. This was a complete surprise. We had up to 23h/day openings to the Midwest, while the predicted blackout between 04-07 did not occur, though signals between 8-10 were much weaker to non-existent. 30m predictions were very close to the 20m behavior. I have no recordings for LP/SP, but looking at the figures, it seems that SP closed much earlier (again: higher LUF?), and my guess is that the 14:30-17 opening was LP, which is quite difficult to predict (though the simulations showed a possible LP opening from 13-23). 40m opened up earlier in the night, but closed much earlier during the day, as clearly the LUF was much higher than predicted. The LP 40m opening did indeed occur, spread out from 12-18, with good workable signals. 80m behaved as predicted, with surprisingly good signals via LP. 160m was a surprise. Clearly, our low radiation angle once again did its job, making the sunset/sunrise borders less critical. Also, our sunrise/sunset were less critical (longer twilight zones) due to the fact that we were in the Antarctic summer. Good antennas on both ends were a must and 15 Midwesterners made it to the 160 log. In general: Propagation to the Midwest was better than expected, with excellent long openings on 20m. The prediction was very close, taking into account that the LP openings are indeed very difficult to predict.

Western North America

	predicted	observed
10m:	SP:22-02 (very low chance)	none
12m:	SP:16-03 (low chance)	none
15m:	SP:16-02:30 (50% chance)	15:30-17
	16:30	Sporadic:19-00
17m:	SP: 15-04	15-18
		sporadic: 18-00
20m:	SP: 14:30-07 (might swing LP)	14:15-08
	SP: 11:30-12:30+22-00	sporadic: 8-14
	LP: 16-17:30	
30m:	SP: 13:30-19+00-12	12-17+23:30-03
	LP: 14-04	
40m:	SP:02:15-17+ 13:30-15	path?: 23-03
	LP: 13:45-04+23-01	LP: 12:30-18:30
80m:	LP:15-17+21:15-02:30	14:30-17+22-00
160m:	LP but vy improbably	14-15

The West Coast was difficult to predict. Being almost at the antipode of Heard, with beamheadings from 180° to 120° (SP), one had to carefully listen for West Coast whenever openings might occur. The operators *did* listen for W6-7 during those openings, logged 4157 QSOs. 10m and 12m predictions were wishful thinking, and did not occur due a low MUF. Only once did 15m open up well to the West Coast, and the opening lasted about 1.5 hours. 42 stations made it to the 15m log, which is much better than I expected. If we had not listened for them, they would have been completely covered up by the East Coast and Midwest. 17m opened as predicted, but closed much earlier. 20m once again was a surprise. The West Coast often came in unexpectedly, but in the predicted peak (14:30-17) they were there almost every day. The West Coast on 20m was almost possible 24h/day, with very sporadic openings from 8-14. SP/LP/skewed path switched very frequently, which is typical for propagation between antipodes. 30m was very difficult to predict because of the antipodal propagation. The peaks occurred at 15:30 (LP) and 03:30 (as predicted). Also 40m is difficult to predict for antipodal propagation. The peak, and most reliable daily opening occurred between 12:30 and 18:30, as predicted, with 23-03 reasonably unreliable SP. A surprising 347 QSOs were made to the West Coast on 80m. During the peak of 14:30-17, we had the strongest opening, with signals peaking over S9 (watch the 75m opening to the West Coast on the VKØIR video!). That opening was predicted, but nobody expected it to be that strong and stable. Near co-occurrance of the gray line and good antennas are the likely explanation. The opening in the middle of our night was less strong. Although to my knowledge, the opening only occurred once, with 16 leftcoasters in the 160m log), who could have thought this would be possible? We worked a couple of stations whose sunrise occurred one hour *before* our sunset. The explanation again may be the very low radiation angle, and the fact that during the Antarctic summer, the grayline is very long. Most of the possible openings were indeed predicted, and optimally used. There is almost no recognizable LUF/MUF pattern in the graphical presentation of the West Coast openings

The "Black Hole" in North America

In compiling the material for this book, I asked Bob Brown NM7M and Carl Luetzelschwab K9LA if they would analyze the VKØIR logs, especially for the 160 m band. Both of them very quickly and generously wrote manuscripts, together with considerable graphics. As much as I wanted to include their entire papers here, there simply was not space. Instead, they will publish these papers in appropriate journals. It is irresistible, howver, to make a few remarks about their findings here, as part of the VKØIR record.

A most interesting point of their analyses is that there is a region across the middle of the US where there would be essentially no chance for a 160m contact with VKØIR. The reason is that if any portion of the path is in daylight, absorption reduces the signal strength below that required for communication. An analysis of the path geometry shows a wedge with apex at the antipode, opening at about 60° (full width) to the South, covering most of Montana, Wyoming, South Dakota, Nebraska, Kansas, Colorado, Oklahoma, Utah, Nevada, Southern California, Arizona, New Mexico, Texas, and Louisiana. If you were in one of those States, you were pretty much out of luck on 160m. The farther away from this wedge you were, the longer was your 160m opening. For most of the US East Coast, it was longer than an hour. The logs bear out the analysis: as the terminator marches across North America, States behind it come alive.

The "black hole" in Central North America.

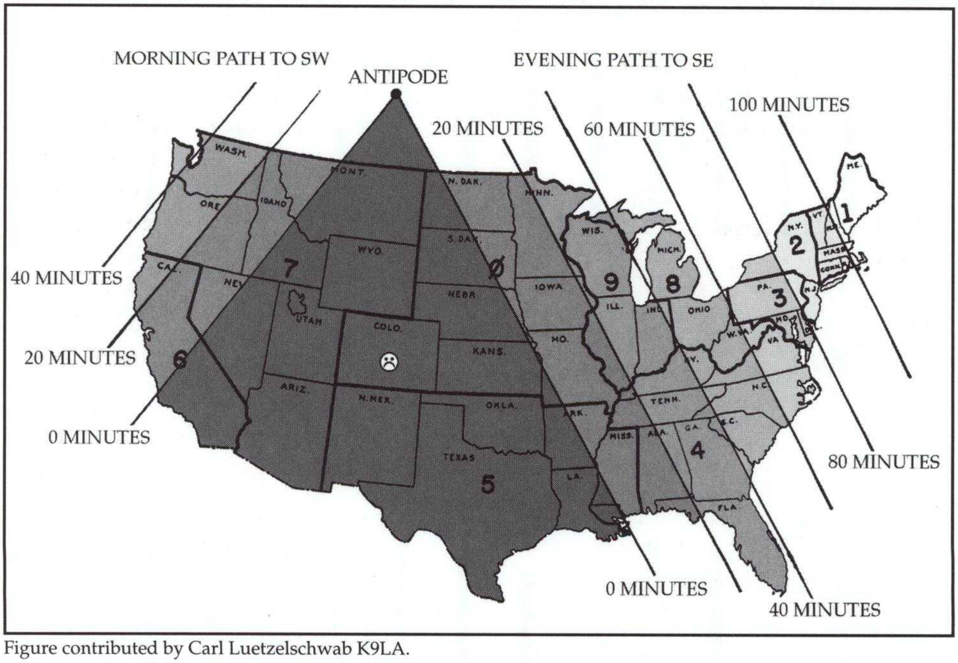
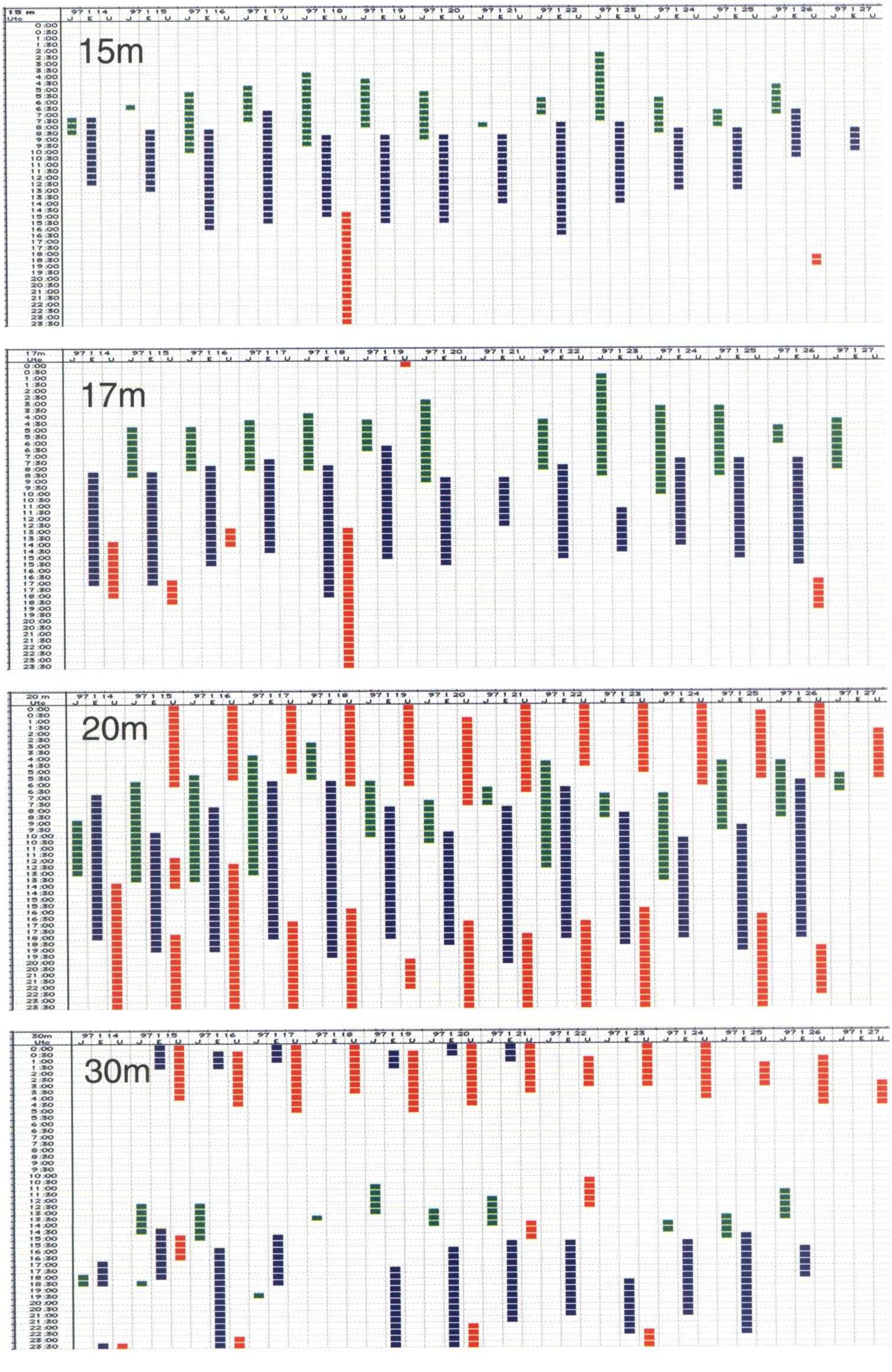
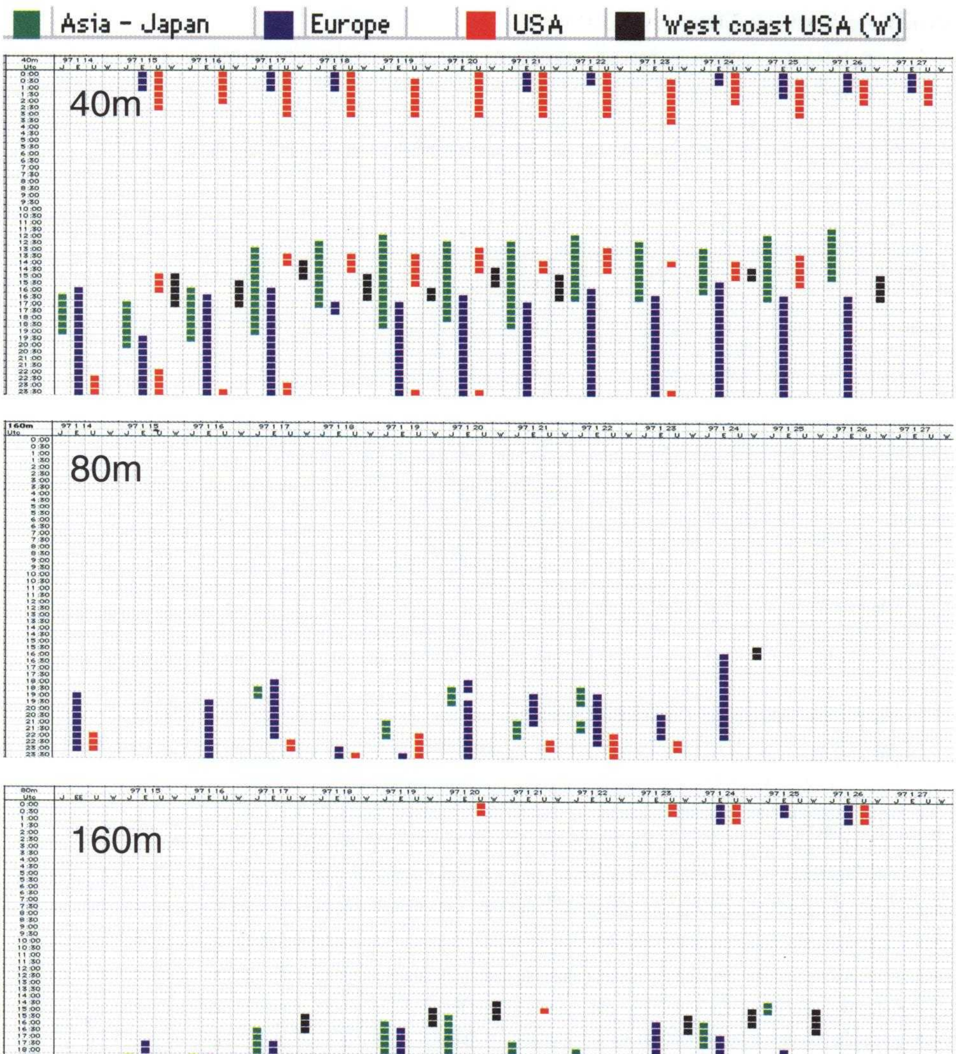


Figure contributed by Carl Luetzelschwab K9LA.

Band Activity vs Time and Date





These two pages show operating activity recorded by VKØIR for each day. In each plot, the origin is in the upper left corner. Time runs from 0000 UTC downward to 2359 UTC, and the dates run horizontally from January 14 to January 24. For each date, the time intervals during which there was activity on the band are indicated by colored markers.

[Contributed by Arno Metzer OE9AMJ]

Working VKØIR QRP

The VKØIR logs contain 57 stations logged explicitly as QRP. It is certain, of course, that there are additional stations that were QRP, but did not sign QRP, or were not logged that way. After I returned, I solicited reports of QRP contacts with VKØIR. Some of these are summarized in this table, listed alphabetically.

Station	Band	Power	Antenna
G4BUE	20	5	TH7 @ 56 ft.
G4BWP	20	5	TH6 @ 65 ft.
K6UM	20	4.5	TA-53M @ 60 ft.
N4KG	30	5	TH6 boom @ 80 ft.
"	20 CW	5	TH6 boom @ 80 ft.
"	20 SSB	5	TH6 boom @ 80 ft.
N9YXA	30 CW	2	@20 ft
NZ8J	30	4	Zepp
OH2BMH	20 CW	2	C3
PY2FR	30 CW	7	3WS @ 75 ft.
VE6JY	20 SSB	5	5 el yagi @ 145 ft.
VE9AA	20 SSB	5	TH6DXX @ 48 ft.
W4YV	20 SSB	5	Th7DX @ 77 ft.
"	30 CW	2	D3W @ 80 ft.
WAØRJY	?	5	5 el KLM @ 88 ft.
WU1F	20	4.5	?

Here are some of their comments:

N9YXA: VKØIR was very strong and did not have a pileup on him, so I gave my call a couple of times, and he replied to me, and gave me a 599 report. I am in the Fox Valley area, a low part of Northern Illinois. My antennas are up around 20 feet off the ground. I am located in Aurora, 40 miles west of Chicago...

OH2BMH: I worked VKØIR on 14 MHz CW with just 2W output. That is according to my DAIWA CN620A SWR & Power meter. My QRP radio is the 'Green Mountain-20' a 20 Meter superhet Transceiver. My antenna is C3 by Force-12. The VKØIR QSO was actually my fourth QRP QSO. I made the first QSO with a local friend on the 6th of January. As I had worked VKØCW in 1983 on 20 meters CW, I had nothing to loose even if I couldn't make it with QRP. On Friday the 24th of January I called VKØIR for more than four hours. I made quick calculations and figured out that if VKØIR is S9+ in Finland, I must be readable on Heard Island. On Saturday the 25th of January VKØIR was LOUD on 14 MHz CW. When I had called for more than an hour and was ready to give up... at 14:18 UTC... OH2BMH 599 K... That moment was one of the most unforgettable moments in my 27 years of hamming.

VE6JY: Jan 25 1901 UTC 14195 kHz, up 5. I made sure to call with VE6JY/QRP or 5 watts so they'd realize I just wasn't trying to make an insurance contact. I use an FT-1000, adjusted for 5 watts on peaks into a good quality peak reading meter (Nye Viking FRM-005). This 5 watts had to go thru over 400 feet of 0.5 inch hardline and then up 145 feet to a homebrew 5 element Yagi on a 48 foot boom. Beam direction was NE into Europe—the best direction most of the time. Since we were so close to the antipode, beaming in the "face on" to their beam heading was the determining factor, it seemed.

Skew Paths

Because of the location of Heard Island relative to North America, there was a lot of talk about skew paths. After returning, I queried the community to try to learn of people's experiences. Here are some of their remarks.

K1VR: One evening I was hearing VKØIR best on 80 SSB using the east Beverage and simultaneously hearing VKØIR best on 160 CW using the south Beverage. I simply cannot explain why south would be the better direction on 160. Both signals were coming through at the same time.

K5YA: I'm located in South Texas, 35 miles north of San Antonio. Short path to VKØIR is 168 deg. Every evening that I could hear VKØIR on 40 meters, the path was somewhere between 50 and 80 deg. Seemed to vary each day, or as sunset approached Heard. Times were 0030-0130. My method for determining direction on 40m is fairly accurate since I have two rotatable antennas at right angles. A 2 element Yagi at 100 ft and a dipole at 105 ft. I can switch instantly between the antennas switch, so I turn them while checking for the null on one of the antennas. As I went toward short path (168 deg) the sigs were weaker but still there. The peak was very broad, as if the signals were coming from a wide range of directions at that time. They were definitely peaking over north central Africa every evening.

K8DO: One evening the signals were only heard on the due south beverage and the SSE sloper, not direct and not NE.

K8GG: Heard Island sometimes came in best at about 70 degrees on 160 meters, sometimes at about 120 degrees. These are the two directions I have beverages that could pick up the signals. Charlie, WØCD, has phased pairs of loops, reversible, NE-SW and SE-NW. There were times the NE was better than the SE. It was sometimes a skew path coming from the SW, as opposed to the NW. The path would change, depending on the relationship to local sunrise. Optimum seemed to be about 40 minutes after sunrise. That could be either true or skew long path. The days were fickle!

KF7E beacon report: VKØIR/B 14.100 14 Jan '97 00:34:10 - 00:46:10 S-1 (weak) peaked at 180 deg (Short Path) from New Mexico DM62PK QSB, then heard again 01:01:10 peaking about 220 deg (skew SP).

N4KG: Many on the East coast report the 160M signal coming from NE rather than direct path (SE). Never heard VKØIR on 160 here in Ala. All bands (80-15) were direct path here in north Alabama.

NT5C: From Austin, SP is 166 degrees and LP 346 degrees. On 40M, our best propagation was consistently around 1330-1430Z LP. In our evenings, let's say from 0000-0100Z, VKØIR would *always* come into W5 extremely weak on a skewed ENE path. It was a broad pattern, more or less the same strength from 35 degrees to 75 degrees, but there was a consensus among the 5s that it centered at 55 degrees. The signals were so weak (S2-3, or 3-5 S-points lower than the morning LP) that only Texans with exceptional antennas managed to work them then—like N3BB/5 with 3-element full size at 125 ft. But that skewed path was not just occasional—it was absolutely consistent as the *only* evening 40M path into Texas.

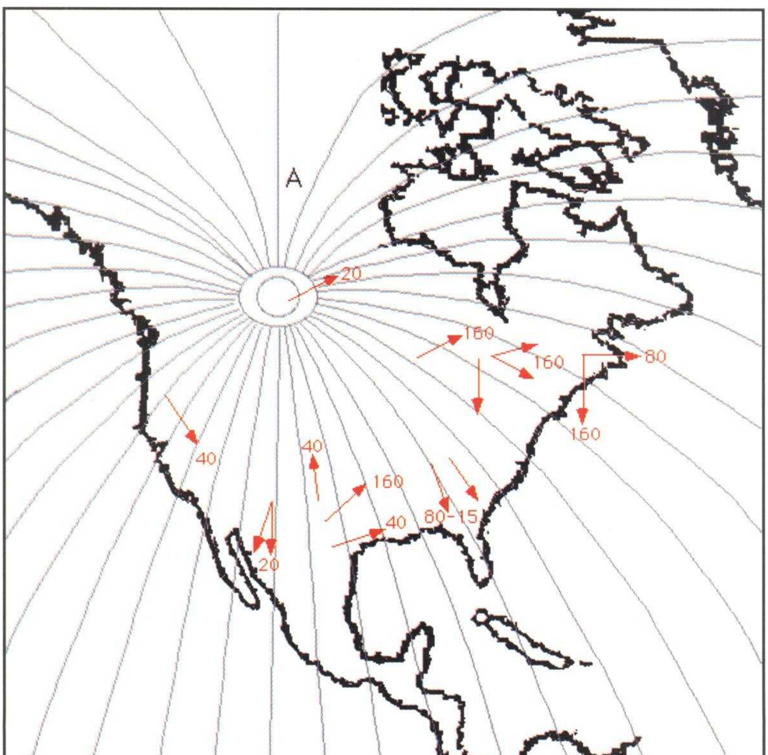
VE5RC: Sam, VE5SF in Regina called me one Saturday morning to tell me he was receiving VKØIR on 20 mtr SSB, 4/5 on the S meter but his beam was peaking the signal on a NE direction. When he turned the beam to the SE (Heard Island) the signal dropped *way* down. I worked VKØIR on 30 mtrs with my dipole sloper facing NE instead of SE

W4DC: Found my SE beverage (120 degree) the best from 80M through 15M.

W7OO: They were always 120 deg for me every time I heard them on 40. I live near Seattle so that is almost 90 degrees to my short or long path.

WB9Z: I have a fairly large a elaborate beverage receiving system. I have about 10 this year, all are terminated and directional. I listened for the VKØ most every afternoon, sometimes as much as 45 min. before sunset. First, I noticed on 80, I would hear VKØIR out of the NE over EU up until sunset and then the path would switch to the direct SE path. On 160, I listened every afternoon until I finally put the VKØ in the log on Jan 22 @ 23:36 (sunset for me on Jan 22 is 22:53). That time the signal was out of the NE with the east beverage close behind and little or nothing out of the southeast. This was interesting but not surprising, as I have noticed this on other stations or expeditions that far south. Other days on 160 before Jan 22, I heard VKØ only 339 at best out of the NE only 1 or 2 times.

From these reports I have extracted the meager details about location and direction of signal. These are displayed in the next plot, in which the arrow indicates the apparent direction of VKØIR, i.e., it is where the signal seemed to come *from*.



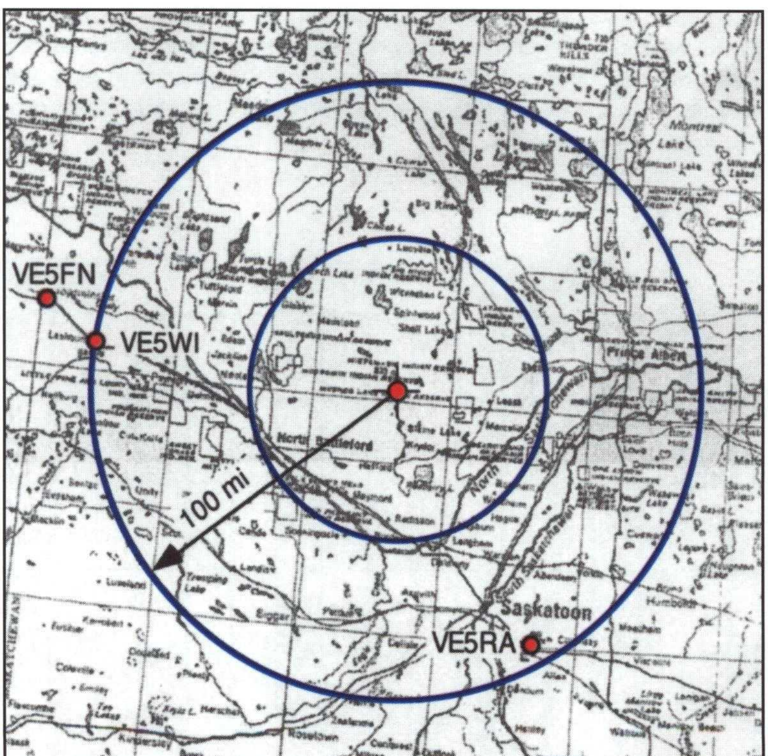
Some reported paths of VKØIR signals. The arrow shows the direction of VKØIR, according to the receiving stations. Flying saucers could land at the antipode if they wished.

The Antipode

VKØIR was located at 53°01.110 min S, 73°23.639 min E. The antipode is at 53°01.110 min N, 106°35.351 min W, not quite a hundred miles from the city of Saskatoon, in the Canadian province of Saskatchewan. The nearby area is farming country, rolling to somewhat hilly, with some of the native vegetation of deciduous trees and prairie grasses. According to Bill, VE5FN, the antipode point is in a local group of hills that extend above the general terrain. There are enough roads that you could probably drive your car close to the antipode itself.

We were quite interested in whether the antipode would be a good (or bad) place from which to contact VKØIR. There is very little data, and we only have anecdotal evidence. That evidence does suggest, however, that the antipode was not so bad. VKØIR logged the following VE5 stations: VE5DX, VE5FF, VE5FN, VE5FX, VE5GC (2), VE5KPU, VE5MX (4), VE5OY, VE5RA (11), VE5RC (3), VE5SF (4), VE5SM, VE5TP (2), VE5UA (2), VE5UO, VE5VL, VE5WI, VE5YP, VE5ZG, where the number of band/modes is indicated.

Looking at the data, Bob N6EK made a pithy comment: "Being at the antipode was not the worst place to be. People right at the antipode may have been helped by antipodal focusing. At least they had their choice of path!"



The region around the antipode. It's not true that watches stop, birds can't fly, and all the cows there are pregnant. However, apparently once a frog lived there that glowed in the dark.

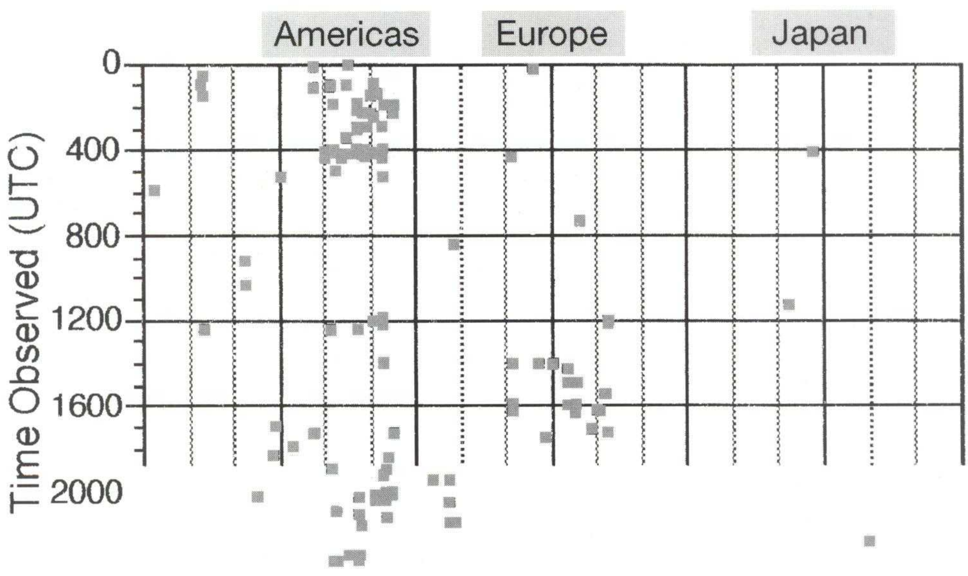
The NCDXF Beacon

Within 24 hours after landing, the Northern California DX Foundation beacon, transmitting VKØIR/B, was put into operation. The purpose of the beacon was to announce the presence of the team on Heard Island and to generate information about propagation. This technique was first used during the XRØY Easter Island DXpedition. The beacon was one of 18 similar beacons worldwide that share the same frequencies but transmit at different times.

The beacon uses a Kenwood TS-50 transceiver, a Cushcraft R5 vertical antenna, a Trimble Navigation Accutime GPS receiver, and a controller designed and built by W6ISQ and N6EK. It automatically cycles through the following frequencies: 14.100, 18.110, 21.150, 24.930, and 28.200 MHz. Each transmission is repeated every three minutes. A transmission consists of the callsign sent CW at 22 WPM, followed by four 1-second dashes. The callsign and first dash are sent at 100 W. The remaining dashes are sent at 10, 1 and 0.1 W.

Pilot Coordinator John ON4UN requested reports of hearing the beacon, and he received about 100 such reports. The following figure shows the longitude and times of the beacon reports. When it was heard for an extended period, the peak or middle of the interval is plotted. The plot clearly shows the Eu peak around 1600 UTC and at least two separate peaks to the Americas, 0-0400 and broadly centered on 2000 UTC. These correlate rather well with the activity logged by VKØIR.

The beacon reports were sent to the team on Heard Island and were used to assist with the propagation predictions and scheduling of operations. The reports alone would not have been sufficient for planning the operation because of their fragmentary coverage. Nevertheless, they were useful for validating and extending the propagation predictions.

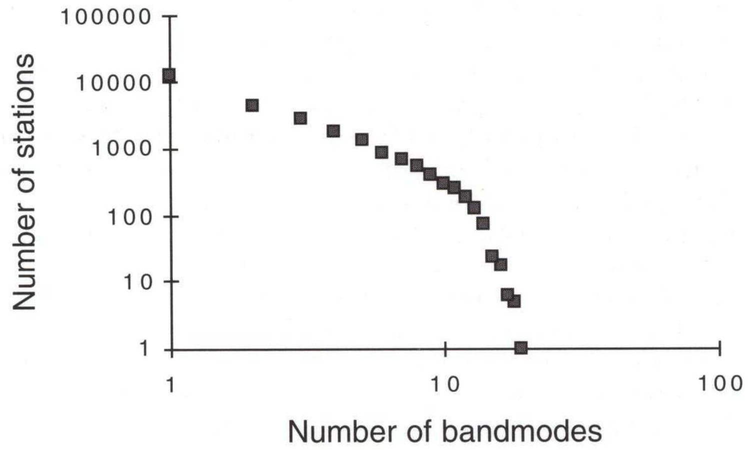


Band/mode Records

[Contributed by Bob Fabry N6EK]

It was possible to work VKØIR on nineteen band-modes: CW on nine bands plus satellite, SSB on seven bands plus satellite (we worked no 160 SSB) and RTTY on 20 meters. The following table shows how many stations worked VKØIR on how many of these band modes.

#bandmodes	#stations
19	1
18	5
17	6
16	17
15	24
14	73
13	125
12	179
11	256
10	296
9	398
8	524
7	686
6	871
5	1316
4	1865
3	2848
2	4623
1	13387



The one station who managed to work us on all 19 band-modes was JA5EXW, and he didn't dupe us a single time! Honorable mention goes to JA2FJP, JA2XW, JA3MHV, A3REK and JA9AVA who worked us on 18 band-modes, and JA2FBY, JA2VPO, JA4DLP, JA4LKB, JA5AVI, JA5NLN, JA5XAE, JH1HGC, JH1ORA, JH4FEB, JR9LKE, and JR9LKF on 17 band-modes.

Outside Japan, A71CW was the leader with seventeen band-modes. IK5PWJ, IK7MCJ, IØJX, OH2BU and OH3SR were the European leaders with sixteen band-modes. 9K2MU, DL1SDN, DL5IAR, DL7MAE, DKØEE, OH1XX, OH2EE, OH5MLF, OZ8ABE, SM3LBN and VK6HD worked us on fifteen band-modes. 4X4DK, DFØSSB, DF3CB, DF9ZP, DJ2YA, DJ5JK, DJ8QP, DK8ZB, DL1YD, DL4CF, DL4MDO, DL7PR, DL7VEE, DL8FBD, EA6NB, GIØKOW, HAØDU, I4AVG, I4LCK, I4MES, JY9QJ, OH1NOR, OH2DW, OH2NSM, OH2QV, OH2WI, OH7MEH, OM5XX, ON4ANT, ON4GG, OZ1CTK, PA3EWP, SM0AJU, SM3EVR and SP4EEZ worked us on fourteen band-modes.

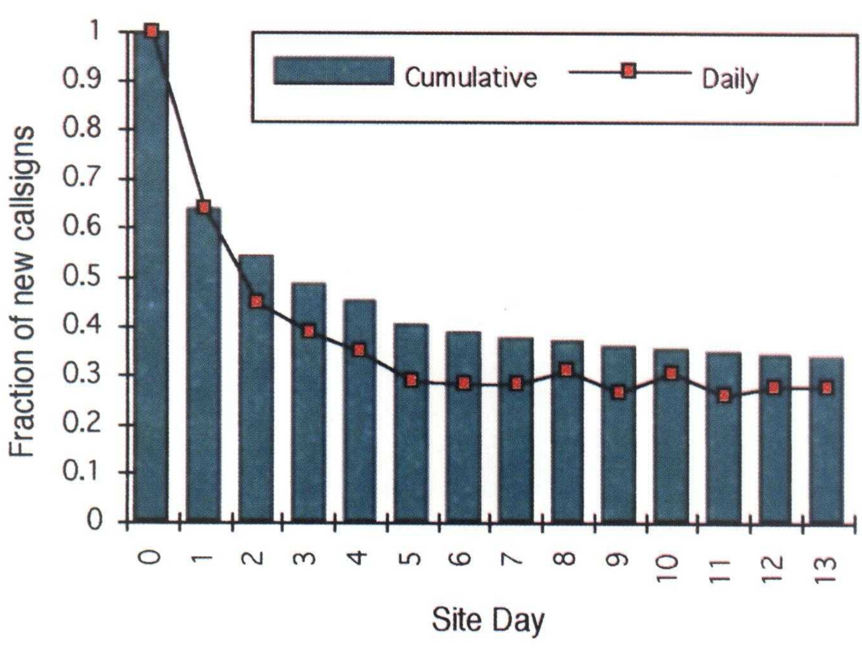
It was a harder path to the Americas. AA1ON, K1GE, K1ST, W1NG, K2TQC, KN2T, N2LT, WA2UUK, K3UA, W3GG, W4MYA, K8YSE, N8TR, N9US and NRØX tied for first place with thirteen band-modes. PY2XB and PY2FR led South America with twelve band-modes. VE1YZ, VE1ZZ, VA3DX, VE3EJ, VE3XO and VE6JY led Canada with twelve band-modes.

New and Unique Callsigns

As the DXpedition progresses, some stations already in the log will contact us again, usually on a different band-mode. One of the expedition's goals was to work as many different stations as possible, so an interesting question is: What fraction of the log represents new callsigns, people contacting the DXpedition for the first time? From the VKØIR logs, it was easy to extract these statistics. The plot below shows the fraction of new callsigns as a function of Site Day, for the daily log additions and the cumulative log. The data show that even at the end of the operation, one-third of the contacts was with callsigns not in the log.

Another question of even greater interest is: *Who* is contacting us? Before the expedition, Peter ON6TT assembled a large database containing the logs from most of the major DXpeditions and contests over the past 10 years. With 100,000 unique callsigns, the database was expected to be a good indicator of who would call VKØIR. To our surprise, we found ourselves logging many stations not in the database, and wondered who they were. Why, for instance, would they contact VKØIR, which is a major challenge, yet not be in the database?

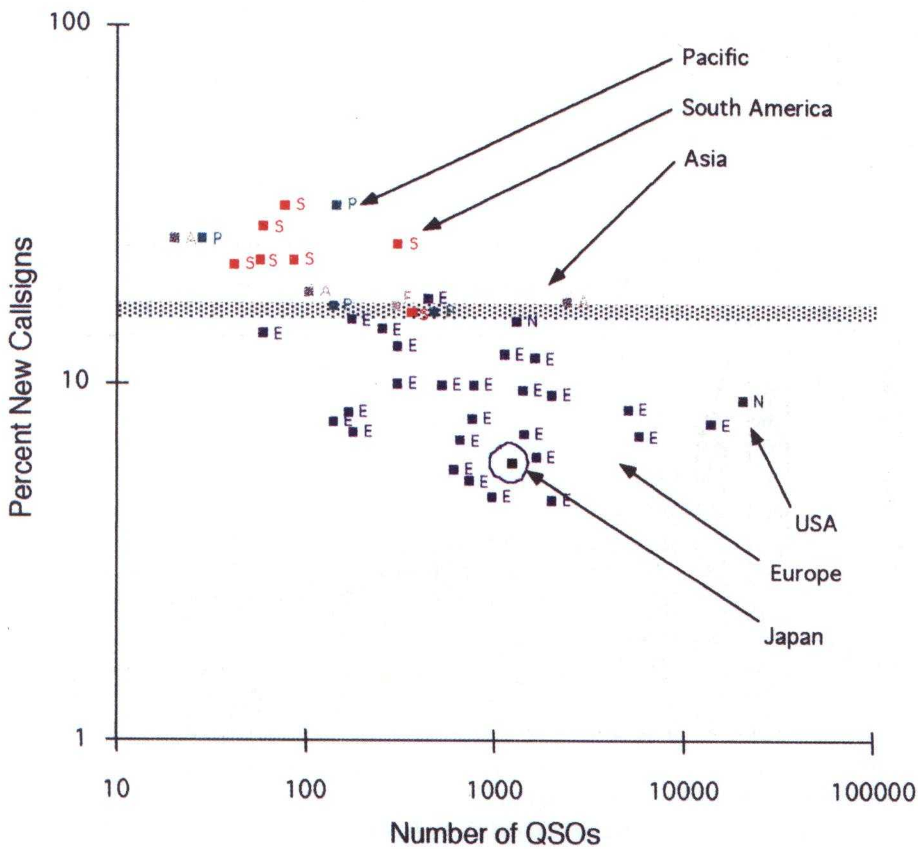
The VKØIR log contains 27,500 unique calls. Of these, 20,911 (76%) appear in the database. The remaining 6,589 callsigns may represent real stations new to this activity, and we were curious to identify them. The following table shows the approximate numbers of these new callsigns for various DXCC prefixes, the total number of QSOs logged for each prefix, and the ratios, sorted by the ratio. In the table, we have identified the location as A=Asia, P=Pacific, E=Europe, F=Africa, N=North America, S=South America, J=Japan. Countries with only a few contacts were omitted from the table, hence the total number of "new" callsigns is 6431 instead of 6589.



A remarkable result emerges from this table: hams in different regions of the world seemed to respond to the VKØIR DXpedition differently. This is seen in the following plot of percentage new callsigns vs number of QSOs. For each prefix in the table, a point is plotted, and identified with the location letter. An freehand curve was drawn around all those points in each region.

Clearly, two major groups seem to emerge: (1) Pacific, South America, Asia, and Africa; (2) Europe, Japan, and the USA. The former group has significantly fewer QSOs but significantly higher percent of callsigns not in the log, while the latter group has more QSOs but fewer callsigns not in the database. There is very little overlap between the two groups; they are divided at 15% (the hatched line in the figure): EU and the USA have fewer than 15% new callsigns, everyone else has more than 15%. How can this be explained?

We have received many letters from hams who said they were returning to the sport of DXing, or were taking it up newly, and a result of VKØIR. It is possible that the cooperative, participatory aspect of the project actually produced many new DXers.



New and unique callsigns in the VKØIR logs

Prefix	DXCC	New Calls	QSOs	%	Location
YB-YF	Indonesia	46	147	31.2	P
HK	Colombia	24	77	31.1	S
ZP	Paraguay	16	59	27.1	S
HS	Thailand	5	20	25.0	A
DU	Philippines	7	28	25.0	P
AX,LU	Argentina	75	307	24.4	S
YV	Venezuela	19	86	22.0	S
XE	Mexico	12	55	21.8	S
CE	Chile	9	42	21.4	S
DS,HL	Korea	19	105	18.0	A
S5	Slovenia	77	444	17.3	E
ER-EU,LY,R,U	Russia	413	2441	16.9	A
ZS	South Africa	50	308	16.2	F
VK	Australia	76	480	15.8	P
PP-PY	Brazil	58	366	15.8	S
ZL	New Zealand	22	141	15.6	P
YO	Romania	26	175	14.9	E
VA-VE,VO	Canada	196	1321	14.8	N
CT	Portugal	36	257	14.0	E
EI	Ireland	8	59	13.6	E
YU	Yugoslavia	39	309	12.6	E
OK-OM	Czechoslovakia	136	1133	12.0	E
EA	Spain	193	1654	11.7	E
9A	San Marino	31	310	10.0	E
OE	Austria	52	527	9.9	E
HB	Switzerland	78	788	9.9	E
F	France	137	1421	9.6	E
SP-SQ	Poland	187	2019	9.3	E
AA-AL,K,N,W	USA	1884	20985	9.0	N
I	Italy	433	5103	8.5	E
SV	Greece	14	169	8.3	E
LA	Norway	62	773	8.0	E
4X-4Z	Israel	11	141	7.8	E
7J-7N,JA	Japan	1082	14013	7.7	J
LZ	Bulgaria	13	178	7.3	E
SA-SM	Sweden	103	1438	7.2	E
DA-DR	Germany	414	5838	7.1	E
OZ	Denmark	45	656	6.9	E
G	Britain	105	1672	6.2	E
PA	Netherlands	35	611	5.7	E
HA	Hungary	40	742	5.3	E
ON	Belgium	47	975	4.8	E
OH	Finland	96	2030	4.7	E
	Totals	6431	70403	9.1	

Realistically, however, some of the calls that VKØIR logged were incorrectly logged. These are what are known as "broken calls." Broken calls occur when an operator does not copy the station's call correctly and the station being worked does not correct it when his call is repeated back incorrectly. They also occur when an SSB operator enters a callsign into the computer different from the one he verbalizes. Most CW operators have the callsign sent by the computer so it is sure to match what was logged, but a few operators send callsigns by hand, which allows an incorrect callsign to be logged without the operator at the other end having a chance to correct it. It is unknown what our rate of broken calls is, and it varies from operator to operator, but a figure of two percent is generally concerned good. If VKØIR had such a rate for the 80,673 contacts, that would imply 1,613 broken calls, and experience shows that the great majority of them will end up in the list of 6,589 callsigns not in our database of expected stations.

Another factor to consider is that many US stations were changing their callsign in the months around the VKØIR expedition. Although ON6TT corrected for some

The Largest DXpeditions

Rank	Callsign	DXCC Country	Date	# QSOs
1	VKØIR	Heard	Jan 1997	80,673
2	4J1FS	M-V Island	May 1992	74,495
3	ZA1A	Albania	Oct 1991	71,000
4	3YØPI	Peter I	Feb 1994	60,000
5	AH3C/KH5J	Jarvis	Apr 1990	55,000
6	AH1A	Howland	Jan 1993	52,410
7	FOØCI	Clipperton	Mar 1992	50,100
8	XYØRR	Near Burma	Aug 1991	50,000
9	3Y5X	Bouvet	Jan 1990	49,000
10	XF4L	Revilla Gigedo	Apr 1989	47,943
11	3D2AM	Conway	May 1990	45,000
12	KP2A/D	Desecheo	Jun 1981	45,000
13	VK9MM	Mellish	Nov 1993	44,500
14	1S1XV/RR	Spratly	Apr 1990	43,265
15	XRØY/Z	Easter	Sep 1995	42,234
16	4J1FS	M-V Island	May 1990	42,000
17	8Z4A	Neutral Zone	Nov 1979	40,800
18	HK0TU	Malpelo	Nov 1990	40,000
19	FOØXA/C	Clipperton	Mar 1978	40,000
20	VP8SSI	South Sandwich	Mar 1992	39,400
21	9M0S	Spratly	May 1993	37,000
22	P5RS7	Near N. Korea	Dec 1991	36,000
23	HC8MD	Galapagos	Nov 1981	35,000
24	ZL8RI	Kermadec	May 1996	33,897
25	KP2A/KP1	Navassa	Mar 1982	33,552
26	ZS9Z/ZS1	Penguin	Dec 1990	33,200
27	AA4NC/KP1	Navassa	Jan 1992	33,000
28	T33R/T33T	Banaba	Nov 1990	33,000
29	YA5MM	Afganistan	Apr 1992	32,000
30	YAØRR	Afganistan	May 1991	31,128
31	3D2CT/CU	Conway	Mar 1994	30,000
32	VKØHI/CW	Heard	Jan 1983	30,000

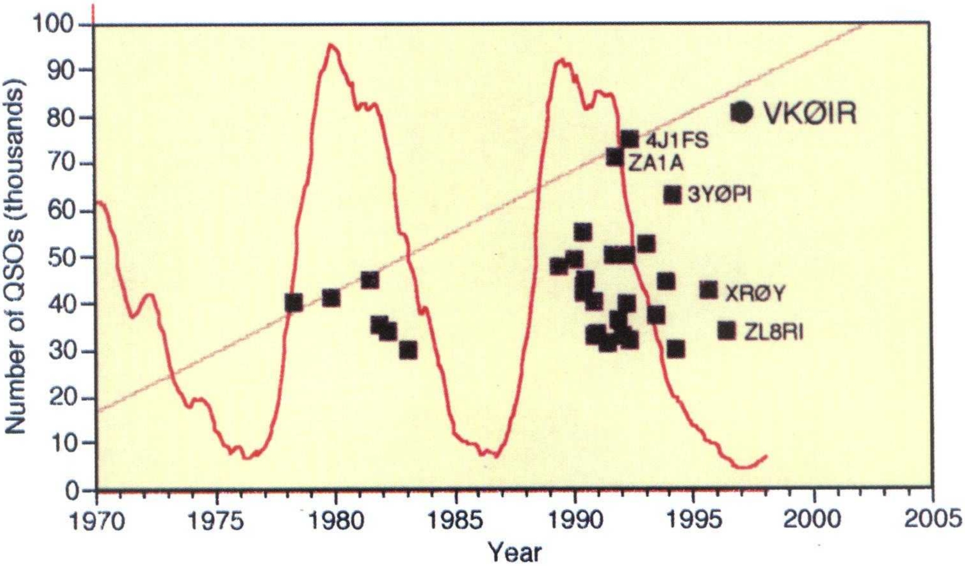
of these changes using lists on the internet, some changes were probably not on the lists he used and additional changes occurred between the time he made his changes and the time we got on the air. This factor could easily account for several percentage points in the US tally, or hundreds of additional callsigns.

N6EK believes that the high percentages of callsigns not in the database for the Pacific, South American and Asian countries largely reflects properties of the database rather than characteristics of the hams who worked VKØIR from these countries. The callsigns which went into the database were collected primarily from North America and Europe. The decision to assume that a callsign which was seen only once was not a valid callsign would exacerbate the lack of callsigns from these areas.

Record DXpeditions

When the record number of QSOs was announced by VKØIR, 80,673, Jari Jusilla OH2BU compiled a list of the largest DXpeditions and the number of QSOs each one logged. The following table was the latest information at publication time:

These data show a most interesting pattern: In the past, most large-scale DXpeditions were done during high solar flux, but this is no longer the case. The following figure shows the number of QSOs vs date, with the smoothed sunspot number superimposed. Between cycles 21 and 22, and between 22 and 23, there were no large DXpeditions. Most large DXpeditions tended to log around 30-50,000 QSOs, mostly during the period when the solar activity was above half of its maximum. The plot on the next page shows these data.



In the past, DXpeditions were done primarily during high sunspot conditions. Several factors have recently changed this.

Then something different happened: Three DXpeditions, 3YØPI, XRØY, and ZL8RI, logged far more QSOs we had a right to expect. This could have resulted from several factors: the DXpeditions making better use of propagation predictions, larger team size (to work multiple bands and every opening), more efficient and reliable hardware, etc. These factors tended to make the *DXpedition* more effective. The maximum number of QSOs that could be recorded in any single event, however, was limited by the number of hams worldwide, the publicity given the operation, the preparation made by hams calling the DXpedition, audience desire for multiple band-mode contacts, etc. These factors tend to make the *audience* more effective. During cycle 23, the 4J1FS and ZA1A DXpeditions had widespread audience interest. Perhaps this led to greater effort by the audience, and therefore significantly higher QSO totals.

The singular accomplishment of VKØIR is therefore seen in the fact that this DXpedition logged such a large number of QSOs at the very bottom of the solar cycle. How was that accomplished? In my opinion, it happened because both the DXpedition *and* the audience prepared extensively. If the DXpedition had not done its technical job well, with the best planning, hardware, training, and personal commitment, it would have failed. And if the audience had not participated by installing new antennas, subscribing the internet, following the news, and personal commitment, it would have likewise failed.

A final point is suggested by the line in the above figure, which represents a simple extrapolation of the highest points. One could imagine that this line represents the maximum number of QSOs that can be logged by a DXpedition, set by the technology. If the line is right, we can expect the first DXpedition to log more than 100,000 QSOs will do it in the year 2003.