Solar Bulletin

THE AMERICAN ASSOCIATION OF VARIABLE STAR OBSERVERS - SOLAR DIVISION

Carl E. Feehrer, Editor
9 Gleason Rd.
Bedford, MA 01730

Email: cfeehrer@hotmail.com

ISSN 0271-8480

Volume 57 Number 4 **April 2001**

Table I. Mean Sunspot Numbers for April 2001

Day	N	Raw	s.d.	K-corrected	s.d.	s.e.
1	37	226	12.0	189	7.9	1.30
2	41	206	9.7	185	8.0	1.25
3	41	209	8.6	182	7.1	1.11
4	47	174	6.6	154	5.3	0.77
5	47	164	5.8	136	4.7	0.69
6	27	153	8.9	131	7.3	1.40
7	32	136	7.6	118	4.8	0.85
8	48	149	6.3	124	4.6	0.66
9	37	141	6.9	125	4.5	0.74
10	29	150	8.9	130	6.5	1.21
11	35	153	8.0	127	5.6	0.95
12	36	132	4.7	115	3.1	0.52
13	50	135	4.4	116	3.7	0.52
14	44	118	3.0	100	2.9	0.44
15	40	97	4.4	79	3.9	0.62
16	36	66	5.1	59	4.4	0.73
17	43	42	2.1	36	1.5	0.23
18	43	54	2.6	47	2.1	0.32
19	50	85	2.9	73	2.7	0.38
20	30	123	5.3	105	3.7	0.68
21	28	153	9.0	131	6.2	1.17
22	40	149	6.0	126	4.1	0.65
23	41	149	7.5	126	5.5	0.86
24	41	153	6.7	136	4.8	0.75
25	45	162	8.0	139	5.1	0.76
26	53	161	6.8	138	5.0	0.69
27	47	160	7.0	133	5.1	0.74
28	50	143	6.2	120	4.2	0.59
29	42	158	6.2	132	3.8	0.59
30	34	131	5.0	108	3.5	0.60
31	—	—	—	—	—	—

Means: 40.5 141.1 120.6

Total No. of Observers: 71

Total No. of Observations: 1214

Table II. April Observers

23	AAP	P.Abbott
4	ANDE	E.Anderson
11	ATON	A.Attanasio
12	BARH	H.Barnes
14	BATR	R.Battaiola
20	BEB	R.Berg
6	BEDJ	J.Bedient
16	BEGM	M.Begbie
10	BERJ	J.Berdejo
17	BLAJ	J.Blackwell
15	BMF	M.Boschat
27	BOSB	B.Bose
26	BRAB	B.Branchett
16	BRAR	R.Branch
25	BROB	R.Brown
11	CAMP	P.Campbell
20	CARJ	J.Carlson
23	CKB	B.Cudnik
8	CLZ	L.Corp
22	COLJ	J.Collins
16	COMT	T.Compton
30	CORA	A.Coroas
26	CR	T.Cragg
7	DEMF	F.Dempsey
21	DRAJ	J.Dragesco
18	DUBF	F.Dubois
26	ELR	E.Reed
15	FEEC	C.Feehrer
21	FLET	T.Fleming
22	FUJK	K.Fujimori
22	GIOR	R.Giovanoni
16	GOTS	S.Gottschalk
7	HAYK	K.Hay
14	HRUT	T.Hrutkay
11	IMPR	R.Imperi
24	JAMD	D.James
10	JEFT	T.Jeffrey
16	JENJ	J.Jenkins
4	JENS	S.Jenner
18	KAPJ	J.Kaplan
28	KHAR	R.Khan
18	KNJS	J&S Knight
13	LARJ	J.Larriba
19	LERM	M.Lerman
21	LEVM	M.Leventhal
18	LIZT	T.Lizak
19	MALK	K.Malde
11	MARE	E.Mariani
29	MARJ	J.Maranon
25	MCE	E.Mochizuki
9	MILJ	J.Miller
20	MMI	M.Moeller
14	MUDG	G.Mudry
14	OBSO	IPS Obs.
18	RICE	E.Richardson
21	RITA	A.Ritchie
6	SCHG	G.Scholl
16	SIMC	C.Simpson
3	STEF	G.Stefanopoulis
21	STEM	G.Stemmler
23	STQ	N.Stoikidis
21	SUZM	M.Suzuki
13	SZUM	M.Szulc
24	TESD	D.Teske
17	THR	R.Thompson
20	URBP	P.Urbanksi
15	VALD	D.del Valle
14	VARG	A.Vargas
16	WILW	W.Wilson
17	WITL	L.Witkowski
21	YESH	H.Yesilyaprak

Reporting Addresses

Sunspot Reports -- **email:** solar@aavso.org
postal mail: AAVSO, 25 Birch St. Cambridge, MA 02138
FAX *(AAVSO):* (617) 354-0665

SES Reports -- **email:** noatak@aol.com
postal mail: Mike Hill
114 Prospect St. Marlboro, MA 01752

Magnetometer Reports -- **email:** capaavso@aol.com
postal mail: Casper Hossfield
PO Box 23, New Milford, NY 10959
FAX: (973) 853-2588 or (407) 482-3963

Table III. Means of Raw Group Counts (RG) and Ratios of Spots to Groups (S:G) in April

Day	RG	S:G	Day	RG	S:G	Day	RG.	S:G	Day	RG	S:G
1	11.6	9.5	9	8.1	7.4	17	3.5	2.0	25	8.4	9.3
2	11.9	7.3	10	8.6	7.4	18	4.1	3.2	26	8.7	8.5
3	13.0	6.1	11	8.8	7.4	19	5.5	5.5	27	8.8	8.2
4	12.0	4.5	12	7.8	6.9	20	6.8	8.1	28	8.1	7.7
5	10.9	5.0	13	8.7	5.5	21	7.6	10.1	29	8.2	9.3
6	9.6	5.9	14	8.5	3.9	22	7.3	10.4	30	6.9	9.0
7	7.8	7.4	15	7.3	3.3	23	7.5	9.9	31	—	—
8	8.7	7.1	16	5.3	2.5	24	7.5	10.4	Mn.	8.3	7.0

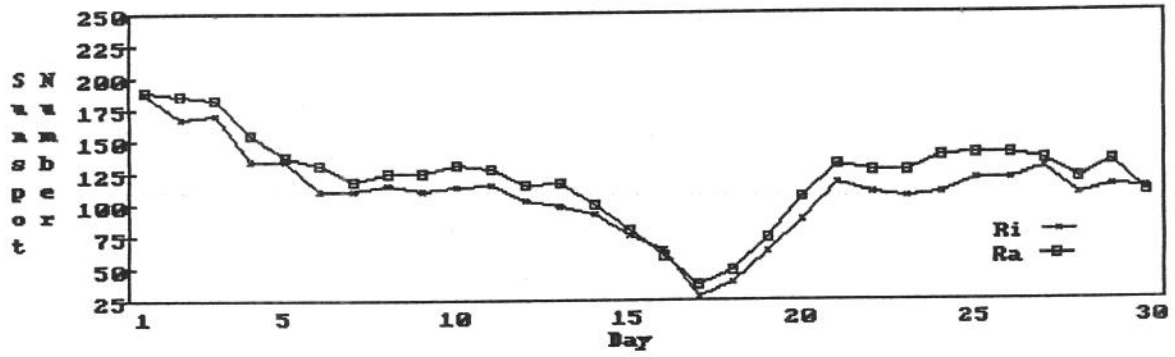


Fig. 1. Comparison of Ri (provisional) and Ra estimates for April.
(Ri Source:http://sidc..oma.be/index.php3)

Smoothed Mean Sunspot Number (Rsm) for October 2000: 119.4

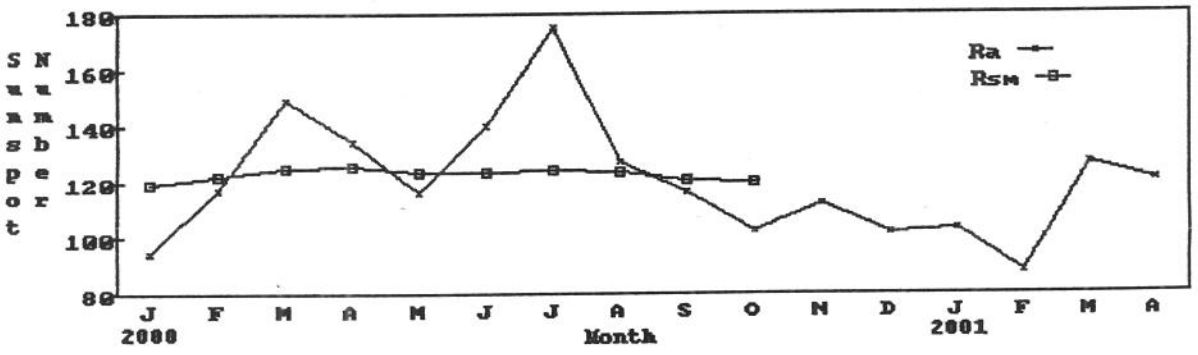


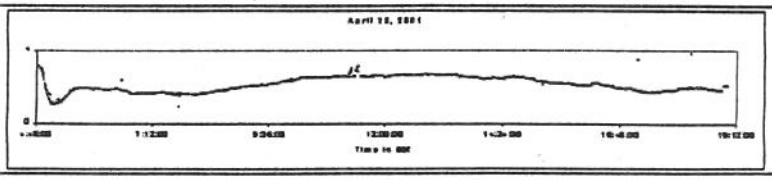
Fig. 2. Monthly Ra and Smoothed Mean Sunspot Numbers (Waldmeier method).

Editor's Note

This month I would like to welcome two new contributors and one former contributor to the group: Jon Wallace (A97) from Torrington, CT and Michael King (A99) from England, both of whom are SID observers, and Mike Begbie (BEGM) from Zimbabwe, who is a sunspot observer. During the mid-1980s, Mike filed reports as part of the Solar Section of the Astronomical Society of South Africa, which at the time was under the directorship of Jim Knight (KNJS), one of our regular contributors. Thank you all for your work and for sending your reports to AAVSO's Solar Division.

Sudden Ionospheric Disturbance Report

Michael Hill, SID Analyst
114 Prospect St
Marlborough, MA 01752 USA
noatak@aol.com



Sudden Ionospheric Disturbances (SID) Recorded During April 2001

(Analysis performed by Michael Hill, SID Analyst)

Date	Max	Imp	Date	Max	Imp	Date	Max	Imp
010401	1100	3+	010413	1207	2+	010422	0817	1
010401	1901	1+	010414	0505	1+	010422	1015	1+
010402	0930	2	010414	1745	3	010422	2042	2+
010402	0950	2	010415	0407	2	010422	2120	1-
010402	1015	2	010415	0610	2+	010423	0125	1+
010402	1121	3	010415	0756	2	010423	1016	1+
010402	2150	2+	010415	0847	2+	010423	2118	2+
010403	1235	1+	010415	1103	1+	010424	0540	2+
010403	1648	1-	010415	1400	3+	010424	0700	2+
010403	1745	2+	010416	0624	2	010424	1218	2+
010403	1850	2	010417	1220	2+	010424	1245	2+
010404	0643	3	010417	1404	3	010424	1809	2+
010404	0820	2+	010417	2143	2+	010425	0510	2
010404	1033	3+	010419	1135	2+	010425	1148	2
010404	1201	1-	010420	0507	2+	010425	1345	2+
010404	1225	2+	010420	1303	2	010425	1543	2+
010405	0510	2	010420	1410	1+	010425	1830	1+
010405	0805	2	010420	1658	1	010426	1245	3
010405	0921	2+	010420	1824	2	010427	0658	1
010406	1919	2+	010420	1918	2	010427	1915	2+
010409	0930	2+	010420	1958	3	010428	0931	2
010410	0518	2+	010420	2135	2	010428	2013	1+
010410	1455	2+	010421	1705	1+	010429	1638	1
010411	1320	3	010421	1809	1	010429	1744	2
010411	1855	2	010421	2206	1+	010429	1924	2
010412	0303	1+	010421	2237	2			
010412	1015	3	010422	0520	1+			

The events listed above meet at least one of the following criteria

1) Reported in at least two observer reports
2) Visually analyzed with definiteness rating = 5
3) Reported by overseas observers with high definiteness rating

Observer	Code	Station(s) monitored
J Winkler	A50	NAA, NPM, xxx
D Overbeek	A52	NAA, NWC, xxx
D Toldo		
A Stokes	A62	NAA
J Ellerbe	A63	ICV
A Panzer	A83	NAA
W Moos	A84	ICV, FTA, GBZ
M Hill	A87	NAA
J Mandaville	A90	NPM
T Poulos	A95	NAA
R Battaiola	A96	HWU
J Wallace	A97	NAA
M King	A99	GYA

Importance	Duration (min)
1-	< 19
1	19 – 25
1+	26-32
2	33-45
2+	46-85
3	86-125
3+	> 125

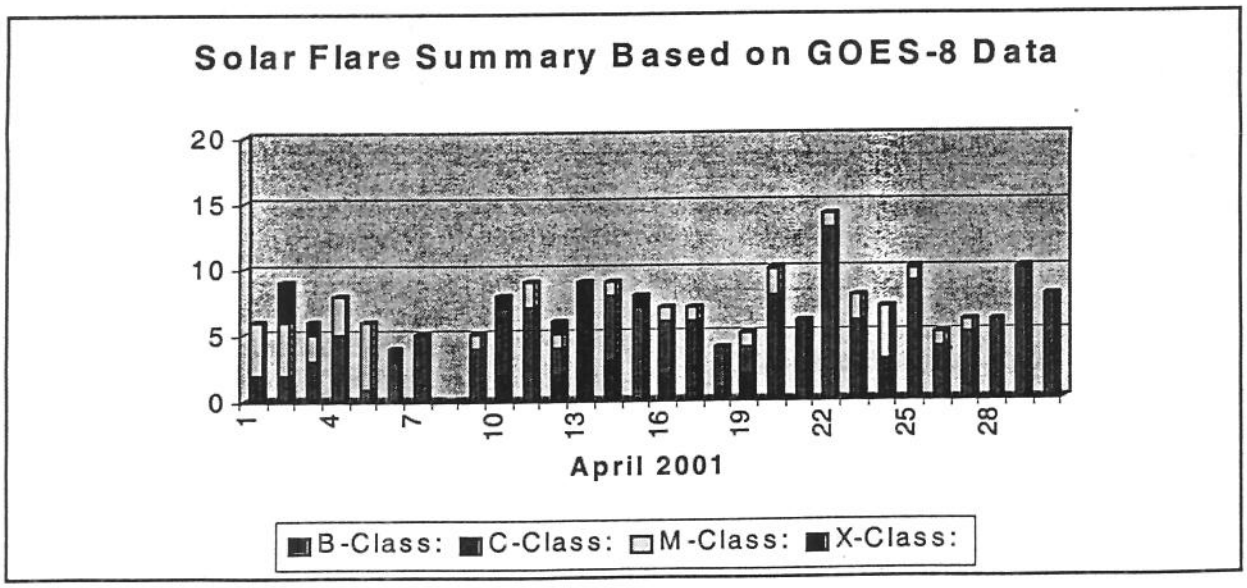
Solar Events

April was another fairly active month, although not as active as last month by any means. The thing I noticed most about the data this month was that there were a lot of very long SID events. This of course corresponded to a lot of large flares. Of the 210 Goes-8 Flares recorded, 8 of them were X-Class and 39 of them were M-Class. Out of the 8 X-Class flares two of them were very large. One was an X17.1 on the 2nd and the other was an X14.4 on the 15th.

Corresponding to this, out of the 79 SID events reported, three of them had an importance rating of 3+ , eight of them had an importance rating of 3, and twenty six of them had an importance rating of 2+. A lot of long duration events!

The X-Class flare on the 2nd resulted in an average rating of 2+, and the X-Class flare on the 15th resulted in an average rating of 3.

Once again I have included a bar graph showing the recorded Goes – 8 flares. It was mentioned last month that the graphs for the time period of 7/00 to 3/01 were posted on the web site. This was never attended to by me, but should be there this month. Also of note - there will be a new article to accompany the antenna article posted a few months back. This one is a series of e-mails between a few of our members about the effects of VLF signal propogation. It is very enlightening and I encourange all of you to read it. It really sheds some light onto some of the effects we see when monitoring VLF signals for SID events.



SOLAR BULLETIN of the American Association of Variable Star Observers. Vol. 57, No. 4 April, 2001

SUDDEN IONOSPHERIC DISTURBANCES SUPPLEMENT

Casper H. Hossfield, SID Sup. Editor
PO Box 23
New Milford, NY 10959, USA

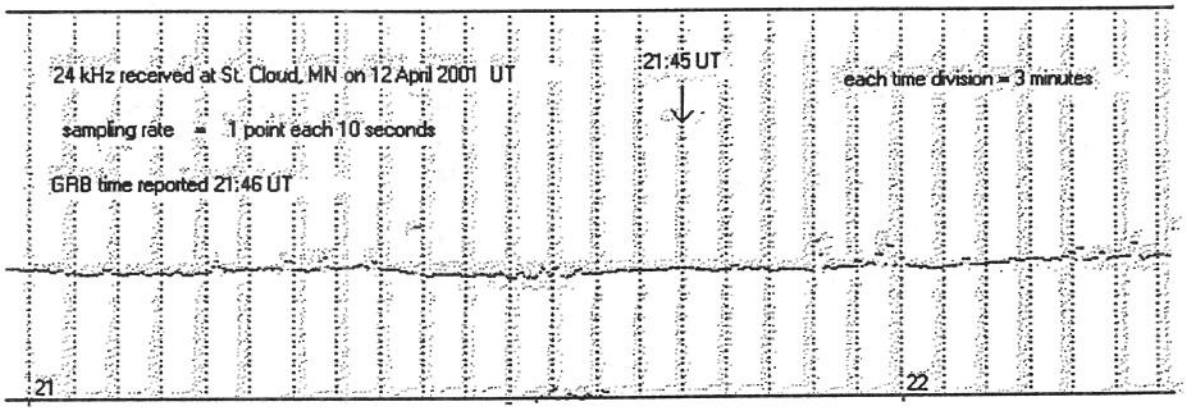
SUDDEN IONOSPHERIC DISTURBANCES RECORDED DURING April, 2001

capaavso@aol.com
Fax 973 853 2588
or 407 482 3963

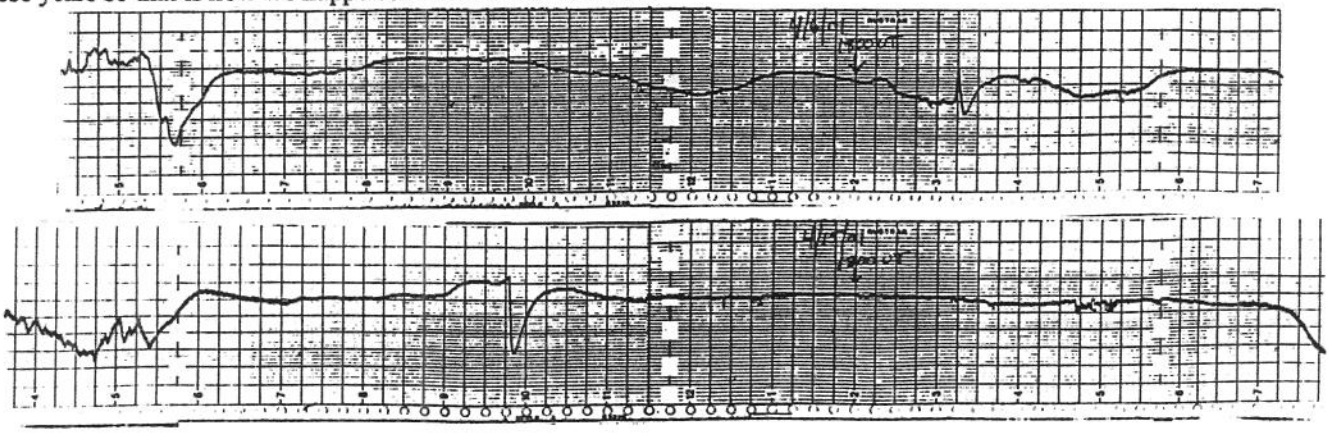
The AAVSO gamma ray burst, GRB, network posted the following message as a GCN on 13 April 01:

"GRB010412 was triggered by the BeppoSAX Gamma Ray Burst Monitor (GRBM) on April 12.907280 U.T and was also detected by the Wide Field Camera (WFC) unit 1 onboard the same satellite. A preliminary analysis of the GRBM data shows a very complex, multi-pulse time profile. The duration is about 75 s and the peak count rate 1896 +/- 59 cts/s, corresponding to a 1 s peak flux of (1.71 +/- 0.06) x 10^(-6) erg/cm2/s in the 40-700 keV energy band.

This was a strong GRB that could possibly have left its signature on the D-layer of the ionosphere as a sudden ionospheric disturbance, SID. If so, it may have been detected by one of the AAVSO's observers who monitor the D-layer to detect SIDs using homemade very-low-frequency, VLF, radio receivers. The VLF receivers are tuned to VLF transmitters scattered around the world transmitting on frequencies between 16 and 50 kHz. Nations that have submarines use these powerful transmitters to communicate with their submerged submarines. They transmit continuously and their signals are propagated by the D-layer which is maintained during daylight by solar ultraviolet radiation. The propagated signal strength of these transmissions is very sensitive to SIDs and can be measured and recorded on a strip chart recorder or computer to show the SID as a sudden enhancement of the signal strength, SES. Most by far, of the SIDs detected are caused by solar flares but a few GRBs have also been detected. With this in mind I alerted all active SID observers but none found an SES signature at the time of the GRB. Below is a recording of the signal strength of VLF station NAA in Cutler, Maine, USA transmitting on 24 kHz. It was made in St Cloud Minnesota, USA by Al McWilliams, A-94. The recording was made on a computer so its time resolution can be expanded to show more detail at the time of the GRB which was 21:45 UT. The expanded chart shows no SID so apparently GRB010412 was not strong enough to produce a detectable SID.



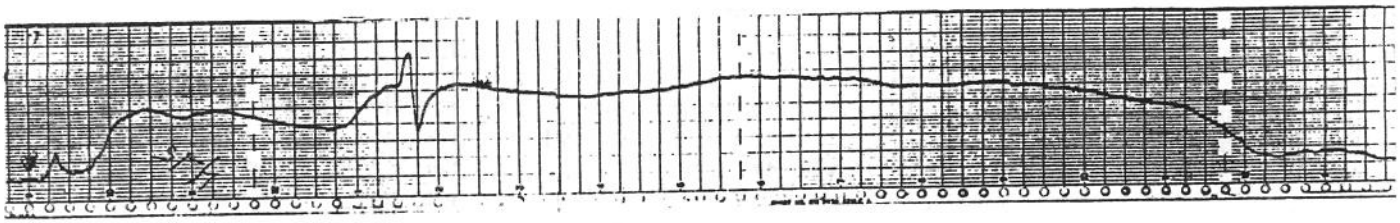
Two SES charts below were made by Andrew Clerkin, A-29. Here is an observer of long ago whom most of you never heard of suddenly sending SES recordings. Andy became an SES observer in 1973 when I was Chairman of the Solar Division and assigned him the designation A-29. I resigned in 1981 so never heard from Andy until recently when our present Chairman, Carl Feehrer discovered him. It is interesting how this came about. Carl and Andy live in the Boston, Mass. Area and have known each other for many years. Recently Carl just happened to mention something about the AAVSO Solar Division to Andy and discovered he was A-29 who dropped out long ago but still had an SES receiver gathering dust in the attic. With a little arm twisting he was persuaded to dust it off and see if it still worked. Much to his surprise it worked just fine after all those years so that is how we happen to have his charts below.



Andy's receiver was built in 1973 by David Warshaw, A-1, who designed it and built it to try out the RCA new CA3035, one of the first operational amplifier integrated circuits to become available commercially. Dave liked to experiment with new electronics products. His interest in experimenting with them dates back to 1956 when he designed and built a transistor VLF receiver using the first Germanium transistors then just coming on the market. This came about when the National Bureau of Standards, NBS, donated four Brown strip-chart recorders to the AAVSO Solar Division to detect solar flares by the SEA (Sudden Enhancement of Atmospherics) method. Harry Bondy was then the Chairman of the Solar Division and knew Dave Warshaw and of his vast experience with electronics so he recruited him to design an SEA receiver for the Solar Division to set up an SEA program. This would make it possible for the AAVSO to participate in the International Geophysical Year, IGY. Dave worked for IT&T at their overseas communication short-wave radio station in Rocky Point, Long Island, New York keeping their radio equipment in good working order so he knew a lot about such things. He also talked IT&T into financing the construction of a quartz monochrometer he built to view the sun in its Hydrogen Alpha line. This was quite a project in those days because it used a series of quartz crystals followed by a final Iceland Spar crystal to separate the H-alpha line. The Iceland Spar crystal eventually cracked but Dave never got around to making a new one. Iceland Spar is difficult to work with. Now you know how the Solar Division got started in the SID business and the early history of the SEA and later the SES program.

On the last page of this SID supplement is a Schematic of Dave Warshaw's first SES receiver to use an op amp IC, the RCA CA3035. I publish this for historical reasons only because today much better Op Amps are available and the Miller slug tuned coils are no longer available. This SID receiver is as good as any as you can see from Andy's charts above, but Art Stokes's Gyrator II is a lot easier to build and tune. For a fixed frequency receiver however, Ferrite core coils are still a good choice. Although the slug tuned coils are no longer available you can get Merrett fixed inductance 20 mH coils from Digi-Key and tune them close with fixed capacitors and then tune them to final resonance at the desired frequency with variable trimmer capacitors that have a polypropalene dielectric. These come in small PC board mounted sizes up to 220 pfd. Two stages of RF amplification, each with a pair of inductively coupled 20 mH ferrite core coils provides enough selectivity to easily separate NAA on 24 kHz from the new 25.2 kHz signal or from NPG on 24.8 kHz

Many observers have remarked on how many of the SESs they recorded in April that were inverted. Both of Andy Clerkin's charts above show inverted SESs. His first chart made on 4 April shows what might be called a double inversion. It starts out rising in the normal way but then changes its mind and quickly inverts downward. Then it reverses direction again and rises more slowly to finish recording the SES. His second chart also shows an inverted SES. This one is almost completely inverted although in the very beginning it does start with a small rise before suddenly inverting. Inverted SESs are not unusual over short propagation paths like Andy's fromNAA at Cutler in the Northeast corner of Maine to Bedford, Massachusetts near Boston. What is unusual is distant observers recorded them inverted in April. Al McWilliams, A-94, in Minnesota and Jerry Winkler in Texas recorded inverted SESs and so did I in Florida. Art Stokes recorded one in Ohio and his are almost never inverted. Below is Art's inverted SES on 15 April. It is interesting to compare it with Andy's recording of the same SES on the 15th. Notice How Art's stays normal going up a bit longer than Andy's



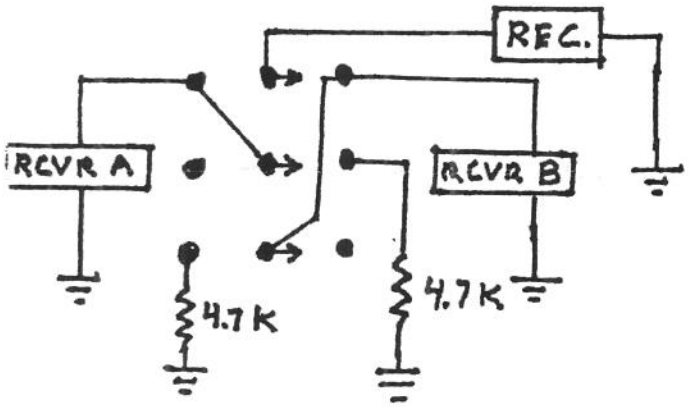
Art also sent a schematic of a multiplexer he is using to record two signals. His schematic is on the next page. For those hoping to record a gamma ray burst, GRB, it will be much more clearly defined if you have it recorded as two signals on the same chart. Danie Overbeek A52's, recording of GRB010222 was on a multiplexed chart of three signals, NAA in Northeastern USA, GBR in England and NWC in West Australia. The fact that the GRB produced an SES on all three of these signals at exactly the right time was what made it almost certain the SESs were the signature of GRB010222. I hope others will follow Art's example and build a multiplexer and record more than one signal.

A Two Input Multiplexer

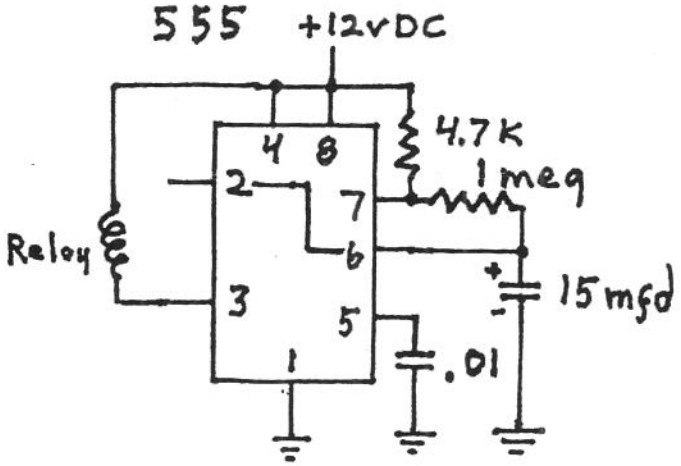
This multiplexer uses a three pole two throw relay to switch the outputs from two receivers to one Rustrak recorder. The relay is switched from receiver A to receiver B by a 555 timer IC at approximately 15 second intervals. With a two second Rustrak, this interval allows about seven hits of the striker bar to mark the chart paper. The relay also simultaneously connects a 4.7 K resistor to the output of the receiver that is not being recorded. This is necessary to maintain a constant load on the integrating capacitor which is thus prevented from charging to a higher voltage during the off cycle.

The 555 timer drives the 12 volt DC relay coil. The timer circuit and relay is mounted on a small piece of perf board. The switching time is set by the 4.7 K and the 1 meg resistor which charge and discharge the 15 mfd electrolytic capacitor. The 1 meg resistor is the primary controlling element since the 4.7 K resistor is small in comparison. Power for the circuit is supplied by a 9 volt DC wall plug transformer. The circuit is shown below:

Relay Connections



Timer Circuit



FOR A29

SID (SUDDEN IONOSPHERIC DISTURBANCES) RECEIVER

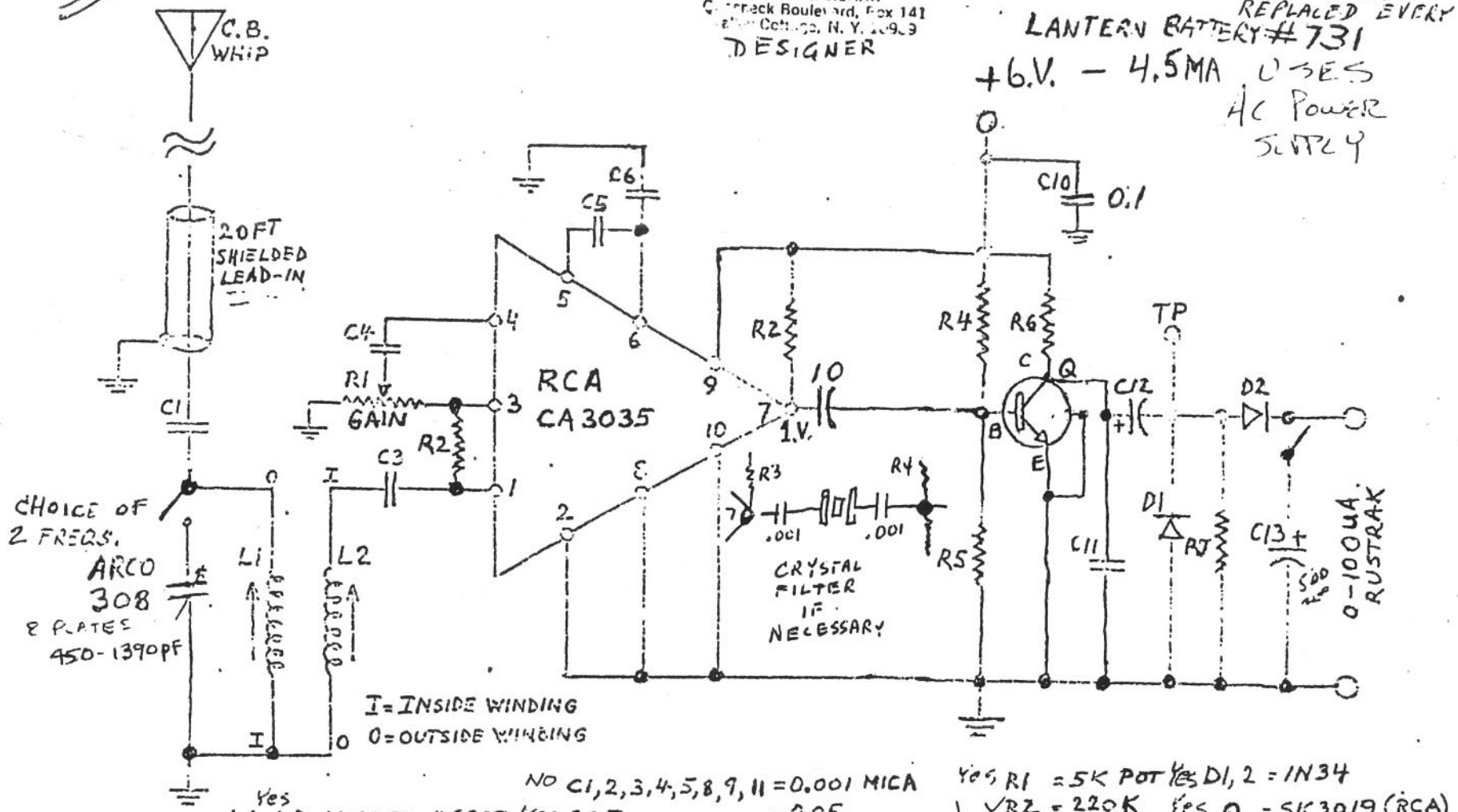
FOR SES (SUDDEN ENHANCEMENT OF SIGNAL)

MODIFIED TO RECEIVE ~~18.5 KHz (NLK, OLYMPIA, WASHINGTON)~~ USING CERAMIC FILTER

DAVID WARSHAW
[illegible] Boulevard, Box 141
[illegible] College, N. Y. [illegible]
DESIGNER

BATTERY SHOULD BE REPLACED EVERY 6 M.

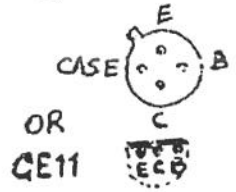
LANTERN BATTERY #731
+6.V. – 4.5MA USES AC POWER SUPPLY



Yes L1, L2 MILLER #6319 (OPEN 7 TURNS)

NO C1,2,3,4,5,8,9,11 = 0.001 MICA
Yes C6,7 = 0.05
Yes C10 = 0.1
Yes C12 = 10uF 15VDC
Yes C13 10, 500 OR 1000uF 15VDC

Yes R1 = 5K POT Yes D1, 2 = IN34
√R2 = 220K Yes Q = SK3019 (RCA)
√R3,5,7 = 10K
√R4 = ~~100K~~ 68K
√R6 = 3300



FEBRUARY 1973