FUTURE NOAA POES SATELLITES AND SENSORS

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At present, uncertainties concerning future funding leave us unsure what the future configuration will be of NOAA's Polar Orbiting Environmental Satellites (POES). Three systems are possible (Figure 2): (a) The present deployment of Morning and Afternoon satellites may continue; (b) Alternatively, a shortage of funds may force reduction of the Metsat fleet to deployment only of an Afternoon spacecraft; (c) A third possibility now under consideration would merge the operations of the NOAA environmental satellites with that of the EOSAT (Landsat) spacecraft.

NOAA's meteorological sensors would ride as paying passengers aboard the EOSAT satellites. However, there are incompatibilities between NOAA's sensors and those of EOSAT, notably between the AVHRR and HIRS, and the Landsat TM. TM is designed for a flight altitude of 700 km; AVHRR and HIRS expect an altitude of 850 km. Cost and time do not permit a redesign of either. Thus it is expected that if a Combined Mission is selected, carrying TM and Metsat instruments, the Morning spacecraft would fly at TM's altitude --and at a later time of day than preferred for meteorological remote sensing-- whereas the Afternoon spacecraft would orbit at the 850 km altitude of the present Advanced TIROS-N (ATN) spacecraft.

A last option (d) is planned for 1995 or later. It is NASA's Earth Observing System (EOS), called also "the Polar Platform." The first EOS mission presumably will be an Afternoon spacecraft, flying at NOAA's preferred altitude. A Morning spacecraft might be provided by NASA at a more distant date, or alternatively, might be supplied by other nations.

Figure 3, showing instruments to be carried aboard various of the optional systems, has been modified since presentation in Madison. This text follows the corrected version:

NOAA-H, I, J, K, L, and M are scheduled to carry an improved HIRS instrument called 2I. If NOAA-D flies in the time-slot shown, that is, after NOAA-H, it will carry the earlier HIRS as flow in -G and previous satellites. Hence the concept that -D (if flown) will carry an old model HIRS (but no older than -G's).

C1 and C2, the first Combined Mission satellites merging Landsat and Metsat operations, are scheduled to be repairable vehicles. Thus R1 is in fact C1, after it has been recovered in space and refurbished.

Note that an uncertainty exists as to whether C2, R1 and R2 (et seq.) will carry HIRS instruments.

In Figure 4, the impact of the Combined Mission's lower Morning orbit is shown. While FOVs are smaller, so also are swath widths, to the detriment of both imaging and computation of low- to mid-latitude soundings.

Figures 5 - 7 show launch schedules for the options a, b, and c discussed above.

In Figure 8, changes in the DSB and HRPT services are shown for the present and next series of NOAA POES spacecraft. The reader may recall that, when this figure was shown at ITSC-III, TOVS data users urged that AMSU data, not HIRS data, be broadcast via the Beacon/TIP VHF channel. This might or might not be a wise strategy, since it would leave users without backup data if early models of AMSU hardware should fail. But either way, radio frequency specialists insist that AMSU data cannot be carried on the present TIP broadcasts. AMSU's data rate exceeds available bandwidth, it is explained.

Figure 9 through 13 show the heritage of experience leading to the AMSU design, and details concerning the operation of the new instrument. Figure 10 explains the entries listed in the subsequent figures. Filters for AMSU channels 5, 10-14 and 18-20 are "split-window" designs, in which energy is collected along the wings of the oxygen and water vapor resonant bands, to be compared with radiation sensed at the peak of the resonances.

Figure 14 shows the spectral channels for the present and future AVHRR designs. In AVHRR/3, Channel 3 contains filters for use in daylight and nighttime operations. In the combination instrument now considered for 1995 and later, a possibility exists that channels 1-3 might be replaced by channels for soundings, to permit deletion of the HIRS instrument, at that time. Note that resolution of the AMRIR may be improved to 500 m at nadir.

ITSC—III

NOAA—SPDS REPORT, AUG. 14, 1986

1. NOAA POLAR SATELLITES
2. AMSU
3. AVHRR

Figure 1

NOAA: POES FUTURE SYSTEMS

PRESENT SYSTEM	FUTURE SYSTEM OPTIONS
	a. AM PM AM PM ...
AM PM AM ...	b. PM PM PM PM ...
	c. AM(TM) PM AM(TM) ...
	d. 1995 OR LATER: EOS PM...(AM?)...AM...

OPTION c. DENOTES A COMBINED MISSION.

Figure 2

INSTRUMENTS:NOAA--G,M vs. COMB.MISSION

NOAA S/C:	G	H	D	I	J	K	L	M
~~HIRS--D~~			X					
HIRS/2	X	X'	x	X'	X'	X'	X'	X'
MSU	X	X	X	X	X			
SSU		X		X				
AMSU A/B						X	X	X
AVHRR	X	X	X	X	X	X*	X*	X*

COMB. MISSION:	C1	C2	R1	R2
HIRS/2	X	X ?	X ?	X ?
AMSU--A	X			
AMSU--A/B		X	X	X
AVHRR	X	X*	X*	X*

(X* DENOTES 5.5 CHANNEL AVHRR.)

(X' DENOTES HIRS MODEL 2I)

Figure 3

NOAA–G,M vs. COMB. MISSION

	NOAA–X		COMBINED		
	AM	PM	AM	PM	
ALT.	850	850	700	850	km
EQ.CRS.	0730	1330	0930/1030	1330	LOC.
HIRS FOV	17.4	17.4	14.3	17.4	km
SWATH	2240	2240	1845*	2240	km
AVHRR FOV	1	1	0.8	1	km
SWATH	2500	2500	2060*	2500	km

(* DENOTES COVERAGE GAPS AT LOW LATITUDES.)

Figure 4

NOAA POLAR LAUNCH SCHEDULE

(ONE SATELLITE SYSTEM)

(ALL PM ORBIT EXCEPT NOAA-G)

SATELLITE	LAUNCH DATE
NOAA-G	JUNE, 1986
NOAA-H	APRIL, 1987
NOAA-I	JUNE, 1988
NOAA-J	DEC., 1989
NOAA-K	JUNE, 1991
NOAA-L	DEC., 1992
NOAA-M	JUNE, 1994

Figure 5

NOAA POLAR LAUNCH SCHEDULE

(TWO SATELLITE SYSTEM)

SATELLITE	TIME	LAUNCH DATE
NOAA-G	AM	JUNE, 1986
NOAA-H	PM	FEB., 1987
NOAA-D	AM	MARCH, 1988
NOAA-I	PM	MARCH, 1989
NOAA-J	AM	MARCH, 1990
NOAA-K	PM	MARCH, 1991
NOAA-L	AM	MARCH, 1992
NOAA-M	PM	MARCH, 1993

Figure 6

NOAA POLAR LAUNCH SCHEDULE
(COMBINED MISSION SYSTEM)

SATELLITE	TIME	LAUNCH DATE
NOAA-G	AM	JUNE, 1986
NOAA-H	PM	DEC., 1986
NOAA-I	AM	JUNE, 1988
NOAA-J	PM	DEC., 1989
NOAA-COM	AM	APRIL, 1989
NOAA-COM	PM	APRIL, 1991
NOAA-REF	AM	OCT., 1992
NOAA-REF	PM	OCT., 1994

Figure 7

NOAA POES SATS: BROADCAST SERVICES

SERVICE	CURRENT	K,L,M (1990)
1. BEACON/TIP (DSB)	HIRS, MSU, SSU	HIRS (ONLY) (NOT AMSU)
2. HRPT	AVHRR, HIRS, ETC.	AMSU, AVHRR, HIRS, ETC.

(FREQUENCY, BANDWIDTH, AND MODE OF BROADCASTS DO NOT CHANGE, FOR BEACON OR HRPT.)

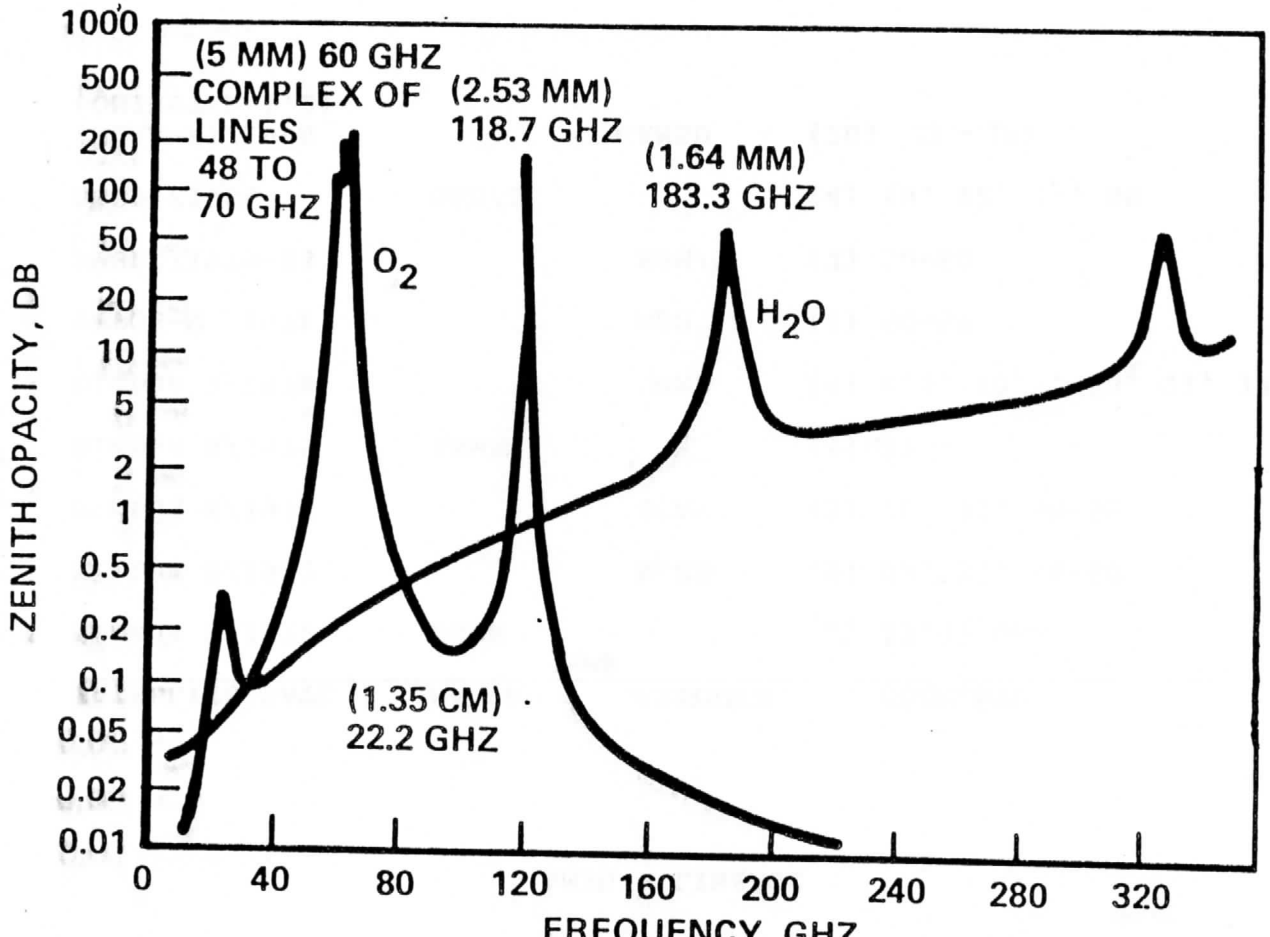
Figure 8

AMSU - LINEAGE

SATELLITE/DATE	IMAGER	SOUNDINGS	COMMENTS
		PMMR	
Nimbus 5/1972	ESMR		(1) 19.35 GHz
Nimbus 5/1972		NEMS	(5) 22, 31, 50-60
Nimbus 6/1975		SCAN	(5) 22, 31, 50-55
Nimbus 6/1975	ESMR		(1) 37
Nimbus 7/1978		SMMR	(5) 6.6, 10.7, 18, 21, 37
TIROS-N /1978		MSU	(4) 50-57
DMSP /1979-83		SSM/T	(7) 50-60
DMSP /1986	SSM/I		(4) 19, 22, 37, 85
(NOAA-K)/1990 (OMINSTAR 1,2)		AMSU	(20) 23 - 183

Figure 9

AMSU: ATMOS. ABSORPTION



MICROWAVE ADSORPTION RESONANCES FOR O_2 AND H_2O

Figure 10

AMSU-A CHANNEL CHARACTERISTICS

CH NO.	CENTER FREQUENCY	BANDWIDTH (MHz)	TEMPERATURE SENSITIVITY (°K) NE T
1	23800 MHz	270	0.3
2	31400 MHz	180	0.3
3	50300 MHz	180	0.4
4	52800 MHz	400	0.25
5	53596 MHz ±115 MHz	170	0.25
6	54400 MHz	400	0.25
7	54940 MHz	400	0.25
8	55500 MHz	330	0.25
9	57290.344 MHz $=f_{LO}$	330	0.25
10	f_{LO} ±217 MHz	78	0.4
11	f_{LO} ±322.2 ±48 MHz	36	0.4
12	f_{LO} ±322.2 ±22 MHz	16	0.6
13	f_{LO} ±322.2 ±10 MHz	8	0.80
14	f_{LO} ±322.2 ±4.5 MHz	3	1.20
15	89.0 GHz	6000	0.5

Beam width of 3.3° gives a nadir FOV of 45 km

Figure 11

AMSU-B CHANNEL CHARACTERISTICS

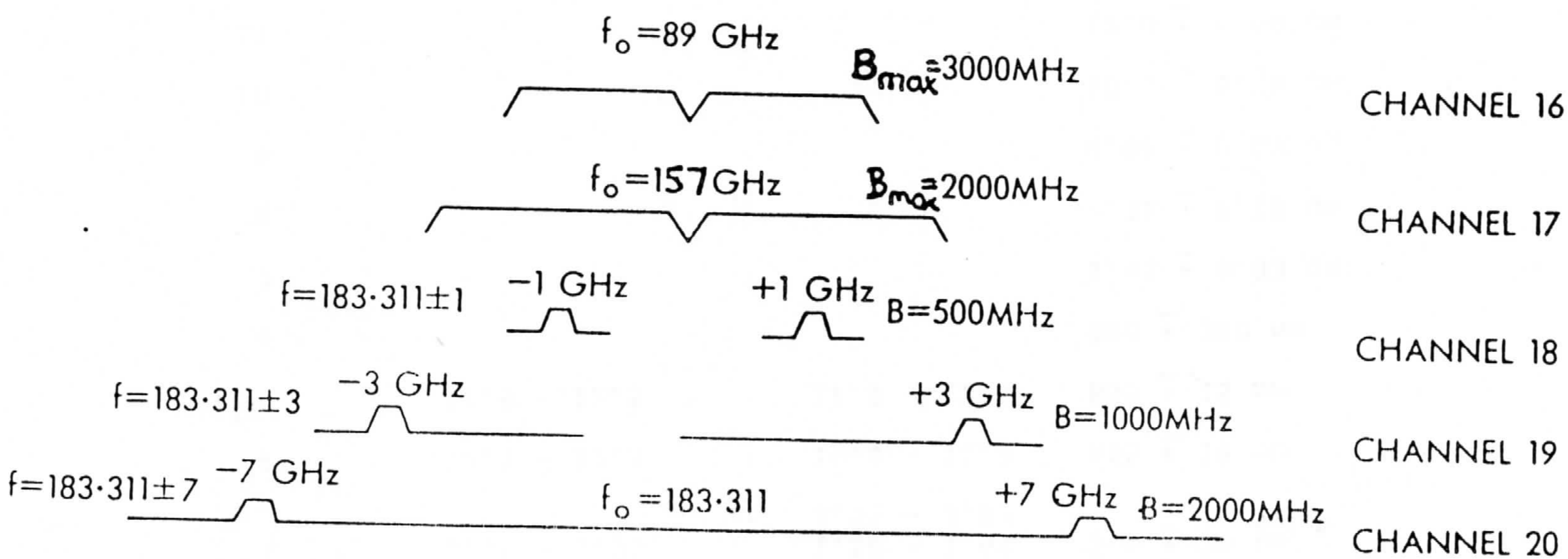
CH NO. DESIGNATION	CENTER FREQUENCY (GHz)	MAXIMUM BANDWIDTH (MHz)	TEMPERATURE SENSITIVITY (K)
16	89.0	6000	0.60
17	157.0	4000	0.60
18	183.31 ± 1.00	1000	0.60
19	183.31 ± 3.00	2000	0.60
20	183.31 ± 7.00	4000	0.60

Beam width of 1.1° gives a nadir FOV of 15 km.

Figure 12

AMSU: CHANNEL FACTORS

CHANNELS 5, 10–15, & 17–20 ARE SPLIT FRAME,
AS SHOWN BELOW.



f_o=Local Oscillator B=Passband Bandwidth f=Centre Frequencies of Passband Centre

Figure 13

AVHRR CHANGES

CH NO.	AVHRR/2 Present (1986-90)	AVHRR/3 (1991-1995)	COMRI/AMRIR (1995--)
1	0.58-68	0.58 -0.68	443 ± 10 nm (50%)
2	0.725 - 1.10	0.84 - 0.87	500 ± 10 nm
3	3.55 - 3.93	1.58 - 1.64 3.55 - 3.93	565 ± 10 nm
4	10.3 - 11.3	10.3 - 11.3	665 ± 10 nm
5	11.5 - 12.5	11.5 - 12.5	855 ± 15 nm
6			800 ± 300 nm
7			1.61 ± 0.03 um
8			3.72 ± 0.10 um
9			4.01 ± 0.09 um
10			10.8 ± 0.50 um
11			12.0 ± 0.50 um
FOV	1 KM (nadir)	1 KM (nadir)	500M (Max)

In the COMIR/AMRIR, channels 1, 2 and 3 may be changed to channels for soundings, to replace the HIRS instrument. Channels 1-7 will have non-linear outputs, to expand sensitivity at low levels. Channel 6 will have commandable along-scan gain control, for day, night and near-terminator imaging.

Figure 14

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