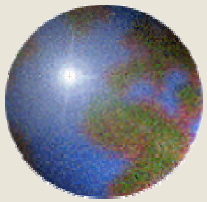

Ocean Science Use of RF Spectrum

by

Otis Brown

Committee on Radio Frequencies

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Overview

- Ocean Sciences has increasing needs for the use of radio frequency spectrum, both active and passive
- Uses include: passive LEO space-based remote sensing, satellite telecommunications (uni- and bi-directional), ocean surface current and wave estimation from radar, traditional ship communications, surface radar, *etc.*
- Surface RFI is affecting passive space and surface observations
- Satellite downlink congestion at X-Band

Space based sensing

- Passive microwave - L/S & X-Band DLs
  - Traditional DMSP and NOAA Instruments (e.g., SSM/I, AMSU-A/B - channels: 23GHz-89GHz/89GHz-183GHz)
  - Earth science instruments (AMSR-E, AQUARIUS (1.4GHz/5GHz/Scat 1.26GHz))
  - NPOESS Instruments (>2010)
  - Limitations due to surface RFI

Space based sensing - continued

- Active microwave
  - Synthetic Aperture Radar (L (1.3GHz), C (5GHz), and X (9.65GHz))
  - Altimetry (5GHz &13GHz)
  - Rainfall mapping (10.65GHz)
  - Surface vector wind estimation (13.5GHz)
  - Cloud winds (CloudSat, 94GHz)
- X-Band DL Congestion (Wende, CORF 2003 brief)

CORF Brief - Wende (05/14/2003)

NASA Mission Summary

	BAND (GHz)	1.25	1.42	1.67	2.65	3.2	4.3	4.9	5.3	6.7	7.15	8.6	9.65	10.65	13.5	15.3	15.4	17.25	18.7	21.3	22.3	23.8	24.1	31.5	35.55	36.5	50.3	55	64.5	78.5	89.	94	101	110	118	150.5	157	166	175.5	183	201	224	236	251	276	301
	ALLOC.	A	P	P	p	a	p	p	A	p	p	A	A	P	A	p	P	A	P	P	P	A	P	A	P	A	P	P	P	A	P	A	P	P	P	P	P	P	P	P	P	P	P	P	P	P
INSTR.	MISSION																																													
ALT	TPX/POS								1						1																																
AMSR-E	AQUA									1				1					1			1				1					1															
AMSU	AQUA																			1	1	1				1	1 2				2							4							
AMSU-A	NOAA K+																					1		1		1	1				1														
AMSU-B	NOAA-K+																														1					1		3							
ATMS	NPP, NPOESS																					1		1		3	9				1			1		5								
HSB	AQUA																																		1		3							
JMR	JASON																		1			1																1						
MHS	NOAA-N																														1				1		1	3						
MLS	EOS-CHEM																																								1				1
MLS	UARS																												1											1	1				
MSU	NOAA-9 - NOAA-14																										1	3																
NSCAT	ADEOS														1																													
PR	TRMM														1																													
QuikSCAT	QuikSCAT														1																													
Radiometer	Proposed		1																														1										
SAR	RADAR-SAT								1																																		
SEAWINDS	ADEOS-2														1																													
SIRC/XSAR	Shuttle	1							1				1																														
SRTM/XSAR	Shuttle								1				1																														
SSALT	JASON								1						1																													
TMI	TRMM													1						1						1					1													
TMR	TPX/POS																		1	1						1																		

Communications/Location fixing

- Autonomous instrumentation (ARGOS, IRIDIUM)
- Vessel comms / coordination (Intelsat/MARISAT, C-Band, …)
- Fixed sites (C/Ku Band, IRIDIUM, …)
- Atmospheric profiling (400MHz service)
- GPS
- Ship Radar (S-Band)

Surface Observing Systems

- Ocean surface current/wave radars (CODAR/WERA (5-50MHz))
- Atmospheric Profiling Systems (50MHz, 400MHz, 1GHz, …)
- Passive infrared/microwave profilers
- Cloud/rain/aerosol finding radars

RFI Impacts

- Limits most space based observations to greater than 50Km from coasts
- Interference with surface wave/current finding systems
- Immediate need for improved frequency coordination!