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Near-Space Remote Sensing

Potential and Challenges

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Preface

Near-Space Remote Sensing: Potential and Challenges deals with the role of near-space vehicles in supplying a gap between satellites and airplanes for microwave remote sensing applications from a top-level system description, with an aim for further research.

Near-space is defined as the atmospheric region from about 20 to 100 km altitude above the Earth's surface. Very few sensors are currently operating in near-space, because the atmosphere is too thin to support flying for most aircrafts and yet too thick to sustain orbit for satellites. Nevertheless, potential benefits for vehicles operating in near-space may include possible persistent monitoring and high revisiting frequency (revisit the same site in a short time interval) that are critical to some specific radar and navigation applications, but not accessible for current satellites and airplanes.

There is a region in near-space where the average wind is <10 m/s; hence, persistent coverage and high flying speed can be obtained for the vehicles operating in this region. Moreover, near-space vehicles are relatively low cost when compared to satellites and airplanes. Additionally, as near-space is below ionosphere, therefore, there are no ionospheric scintillations that will significantly degrade microwave communication and navigation performance which explains why near-space has received much attention in recent years and why several types of near-space vehicles are being studied, developed, or employed.

Near-space vehicles offer the long-term persistence traditionally provided by satellites while providing the fast responsiveness of airplanes. Near-space thus offers an opportunity for developing new synthetic aperture radar (SAR) remote sensing techniques. Several potential applications such as passive surveillance, reconnaissance, high-resolution wide-swath remote sensing, and ground moving targets indication (GMTI) are described in this book.

Near-space vehicle-borne SARs cannot replace spaceborne and airborne radars, but they could provide more efficiently remote sensing functionality than spaceborne SARs. Although near-space vehicles have much smaller coverage area than satellites due to their lower altitude, they can still offer a regional coverage of hundreds of kilometers and provide cost-effective remote sensing services.

Near-space vehicle-borne SARs could also extend remote sensing services into areas with limited or no access to spaceborne and airborne SARs. Therefore, given their operational flexibility, near-space vehicle-borne SARs may supply a gap between spaceborne and airborne SARs which is the reason why we appeal to the system engineering community for more publication and support on the research and development of near-space vehicle-borne SARs.

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Contents

1	Introduction	1
1.1	Background	1
1.1.1	What is Near-Space.	1
1.1.2	Near-Space Environment	2
1.1.3	Why Near-Space Remote Sensing.	3
1.2	Outline of the Chapter	3
	References	4
2	Near-Space Vehicles: Remote Sensing Advantages.	5
2.1	Near-Space Vehicles	5
2.1.1	Free-Floaters	5
2.1.2	Steered Free-Floaters.	6
2.1.3	Maneuvering Vehicles	7
2.2	State-of-the-Art	8
2.2.1	In North America	8
2.2.2	In Europe.	9
2.2.3	In Asia-Pacific	10
2.3	Comparative Advantages	11
2.3.1	Inherent Survivability	11
2.3.2	Persistent Region Coverage or High-Revisiting Frequency	12
2.3.3	Relative High Sensitivity and Large Footprint	13
2.3.4	Low Cost.	13
2.4	Limitations and Vulnerabilities	14
2.4.1	Launch Constraints	14
2.4.2	Survivability Constraints	14
2.4.3	Legal Constraints	15
2.5	Concluding Remarks	15
	References	16

3	Near-Space Vehicles in Passive Remote Sensing	19
3.1	Near-Space Vehicles in Passive Surveillance	19
3.1.1	System Configuration	19
3.1.2	Signal Models	20
3.1.3	Target Location	22
3.1.4	Power Budget Analysis	23
3.2	Near-Space Vehicles in Passive BiSAR Imaging	24
3.2.1	System Imaging Performance	25
3.2.2	Azimuth-Variant Characteristics	30
3.2.3	Two-Dimensional Spectrum Model	31
3.2.4	Image Formation Processing	33
3.3	Near-Space Vehicles in Passive Environment Monitoring	36
3.4	Potential and Challenges	38
3.4.1	Potential Applications: Homeland Security	39
3.4.2	Potential Applications: Persistently Disaster Monitoring	39
3.4.3	Challenges: Synchronization Compensation	40
3.4.4	Challenges: Motion Compensation	43
3.4.5	Challenges: Antenna Directing Synchronization	45
3.5	Conclusion	47
	References	47
4	Near-Space Vehicles in High-Resolution Wide-Swath Remote Sensing	51
4.1	Restrictions on Achievable Resolution and Swath	51
4.2	State-of-the-Art: HRWS Remote Sensing	53
4.2.1	Multiple Apertures in Elevation	53
4.2.2	Multiple Channels in Azimuth	54
4.2.3	Multiple Apertures in Two Dimensions	55
4.2.4	Distributed SAR Constellations	55
4.3	Near-Space Vehicle-Borne SAR HRWS Remote Sensing	56
4.3.1	Single-Phase Center Multibeam SAR Imaging	56
4.3.2	Multiple Phase Center Multibeam SAR Imaging	59
4.3.3	Ambiguity-to-Signal Ratio Analysis	64
4.3.4	Conceptual System Design	67
4.4	Near-Space HRWS Remote Sensing via Multiple Apertures	67
4.4.1	System Architecture and Imaging Scheme	68
4.4.2	Imaging Performance Analysis	72
4.4.3	Conceptual Examples and Simulation Results	74
4.5	Near-Space HRWS Remote Sensing via Waveform Diversity	77
4.5.1	Waveform Diversity Design	78
4.5.2	MIMO SAR-Based Wide-Swath Remote Sensing	81

4.5.3	Space-Time Coding MIMO SAR for High-Resolution Imaging	85
4.6	Conclusion	94
	References	95
5	Near-Space Vehicles in Ground Moving Target Indication	99
5.1	MIMO SAR with Multi-Antenna in Azimuth	99
5.2	MIMO SAR-Based GMTI Processing	101
5.3	Simplified FrFT-Based Parameters Estimation	105
5.3.1	Simplified FrFT Algorithm	105
5.3.2	Simplified FrFT-Based Estimation Algorithm.	106
5.4	Simulation Results	108
5.5	Conclusion	109
	References	109
6	Summary	111
6.1	Realistic Near-Space Remote Sensing Issues.	111
6.2	Future Work	112
6.2.1	High-Precision Imaging Algorithm	112
6.2.2	Waveform Diversity Design	112
6.2.3	Three-Dimensional Imaging	113
	References	114