



SSPACE-AAReST-SDD

Systems Design Document

IIST-AAReST Mirror Satellite Mission

Revision 1.0

June 20, 2019



Small Spacecraft and Payload Centre (SSPACE)
Indian Institute of Space Science and Technology
Thiruvananthapuram, India



Control Sheet

1	Document Number	SSPACE-AAReST-SDD
2	Title H.	Systems Design Document
3	Type of Report	Technical
4	Number of Pages	
5	Version number	1.0
6	Originating Unit	SSPACE, IIST
7	Distribution	Limited to IIST, Caltech and University of Surrey

Abstract

Future space telescopes with diameter over 20 m will require new approaches: either high-precision formation flying or in-orbit assembly. It is believed the latter holds promise at a potentially lower cost and more practical solution in the near term, provided much of the assembly can be carried out autonomously. To gain experience, and to provide risk reduction, AAReST (Autonomous Assembly of Reconfigurable Space Telescope), a combined micro/nano-satellite demonstration mission is proposed. The mission will focus on the required optical technology (adaptive mirrors, phase-sensitive detectors) and autonomous rendezvous and docking technology (inter-satellite links, relative position sensing, automated docking mechanisms). The mission will involve two “3U” CubeSat-like nanosatellites (“MirrorSats”) each carrying an electrically actuated adaptive mirror, and each capable of autonomous un-docking and re-docking with a small central “15U” class micro/nano-satellite core, which houses two fixed mirrors and a boom-deployed focal plane assembly. All three spacecrafts will be launched as a single 40 kg micro-satellite package. On orbit, the mission profile will firstly establish the imaging capability of the, Electrical Power Supply, Propulsion system and the Structure for the Mirror Satellite is currently under development at IIST. Launch is planned for 2020. This report details the mission concept; technology involved and progress to date, focussing on the spacecraft buses.

Keywords : AAReST, Satellite, Space Telescope, Docking, CDH, ADCS, IIST



Approvers List

	Title	Name	Signature
Prepared By	Systems Engineer	Sanidhya Vijaywat	
Approved By	Faculty Mentor	Dr. Priyadarshan H.	
Approved By	Faculty Mentor	Dr. Harsha Simha M.S.	
Approved By	Chairman SRMC	Mr. M.V. Dhekane	



Revision History

Rev.	Date	Change Description	Pages Affected
1.0	June 20, 2019		



Contents

List of Figures	ix
List of Tables	xi
List of Algorithms	xiii
Abbreviations	xv
Nomenclature	xvii
1 AAReST Mission	1
2 Related Work	3
2.1 Summary	3
3 Conclusions	4
Bibliography	4
List of Publications	7
Appendices	9
A Appendix A Title	9
A.1 Section 1	9
A.2 Section 2	9

B	Appendix B Title	10
B.1	Section 1	10
B.2	Section 2	10



List of Figures



List of Tables



List of Algorithms



Abbreviations

GNU GNU's Not Unix
EMACS Editor MACroS



Nomenclature

m Mass of the object

c Velocity of light



Chapter 1

AAReST Mission

The latest space telescope being developed by NASA is the James Webb Space Telescope (JWST), rightly called as scientific successor of Hubble telescope. The JWST has primary mirror aperture of 6.5m diameter, which is much larger than the Hubble telescope, which has primary mirror aperture of 2.4m diameter. AAReST is a pre-cursor mission to demonstrate risk reduction, low cost, reliability and an alternative to autonomously construct the telescope in space, by docking the mirror elements together, to provide aperture more than 20m diameter. The overall goal of AAReST mission, is to create and demonstrate the technology fundamental to the eventual hardware development of a both segmented and sparse, coherent, >30m diameter class aperture telescope utilizing a mosaic primary mirror where each hexagonally shaped mirror segment is attached to a low-cost small satellite (Mirror Sat) that can execute autonomous rendezvous and



wenvlrwnb



Chapter 2

Related Work

Write related work here.

2.1 Summary



Chapter 3

Conclusions

Conclusions here.



Bibliography



List of Publications

Refereed Journals

1. Journal 1
2. Journal 2

Refereed Conferences

1. Conference 1
2. Conference 2

Others



Appendix A

Appendix A Title

A.1 Section 1

Data for Appendix A.1 here

A.2 Section 2

Data for Appendix A.2 here



Appendix B

Appendix B Title

B.1 Section 1

Data for Appendix B.1 here

B.2 Section 2

Data for Appendix B.2 here