



PRoViScout - Planetary Robotics Vision Scout

FP7-SPACE-2009-1 Collaborative Project Grant Agreement no: 241523

Project Homepage: www.proviscout.eu starting: Apr 2010 duration: 30 months

D6.6.2 ProViScout Internal Tests Summary

Actual submission date: 2012-04-30

Work package 6 – Simulation & Testing

Lead contractor for this deliverable AU

Dissemination level: Confidential, only for members of the consortium (including the Commission Services)

EXECUTIVE SUMMARY

This document brings together and summarises in one place all of the internal testing that has been undertaken throughout the PRoViScout project. Hardware and software testing has occurred on many occasions during the project. Some of this work has involved the testing of individual hardware and software components in isolation (referred to as 'unit' testing), whilst other work has brought the components together for integration tests. The driving force throughout has been to ensure that the goals of the PRoViScout project would be delivered, and a successful final Tenerife Field Trial in September 2012 would be achieved. Five integration tests have been conducted during the PRoViScout project, and much has been learnt from these endeavours. Each integration test has been followed by improvements being made by the PRoViScout partners with regards to their respective hardware and software responsibilities. The integration tests started in the laboratory, but then moved outdoors and involved a major campaign away from any convenient infrastructure support, and more representative of the remote challenges that will be faced in Tenerife. This document provides an overview of all of the internal unit testing and integration campaign tests undertaken during the project. All of the key hardware and software components within the project are represented, and the document shows the steady evolution of the various systems as problems have been discovered and solutions found.

Table of Contents

1. DOCUMENT CONTROL	2
2. ISSUE RECORD	2
3. EXECUTIVE SUMMARY	3
4. INTRODUCTION	7
4.1 Purpose, Scope and Structure	7
4.2 Acronyms	8
4.3 References	9
5. TESTING OVERVIEW & STRATEGIES	11
6. HARDWARE/SOFTWARE UNIT TESTS AND RESULTS	12
6.1 Rover Platform	12
6.2 Aerobot	14
6.3 Vision Sensors	15
6.3.1 CSEM Time-of-Flight (3D-TOF)	15
6.3.2 AU PanCam Emulator (AUPE)	17
6.3.3 MSSL Hyperspectral Camera (HyperCam)	19
6.3.4 MSSL Wide-Angle Laser Imager (WALI)	20
7. SOFTWARE MODULE COMPONENTS UNIT TESTS AND RESULTS	21
7.1 PROVIM	21
7.1.1 Overseer	21
7.1.2 Vision and Rendering	23
7.2 PROVISC	25
7.2.1 Executive	25
7.2.2 MMOPS	25
7.2.3 Science Assessment	26
7.2.4 Navigation	26
7.2.5 Vision Processing	28
8. INTEGRATION CAMPAIGNS TESTS AND RESULTS	30
8.1 Integration Campaign 1 & 2 - @ SciSys	30

8.1.1	Executive	30
8.1.2	MMOPS	30
8.1.3	Science Assessment	31
8.1.4	Navigation	31
8.1.5	Vision Processing	32
8.1.6	Rover Platform	32
8.1.7	AU PanCam Emulator (AUPE)	32
8.2	Integration Campaign 3 - @ AU PatLab and Workshop	33
8.2.1	Rover Platform	34
8.2.2	Aerobot	34
8.2.3	CSEM Time-of-Flight (3D-TOF)	34
8.2.4	AU PanCam Emulator (AUPE)	34
8.2.5	MSSL Hyperspectral Camera (HyperCam)	35
8.2.6	MSSL Wide-Angle Laser Imager (WALI)	35
8.2.7	Executive	35
8.2.8	MMOPS	35
8.2.9	Science Assessment	35
8.2.10	Navigation	35
8.2.11	Vision Processing	36
8.3	Integration Campaign 4 - @ Ysbyty Ystwyth	36
8.3.1	Rover Platform	38
8.3.2	Aerobot	38
8.3.3	CSEM Time-of-Flight (3D-TOF)	39
8.3.4	AU PanCam Emulator (AUPE)	40
8.3.5	MSSL Hyperspectral Camera (HyperCam)	40
8.3.6	MSSL Wide-Angle Laser Imager (WALI)	40
8.3.7	Executive	41
8.3.8	MMOPS	42
8.3.9	Science Assessment	42
8.3.10	Navigation	42
8.3.11	Vision Processing	46
8.4	Integration Campaign 5 - @ AU Workshop - Remote Tests	47
8.4.1	Rover Platform	47
8.4.2	Aerobot	47
8.4.3	CSEM Time-of-Flight (3D-TOF)	48
8.4.4	AU PanCam Emulator (AUPE)	48
8.4.5	MSSL Hyperspectral Camera (HyperCam)	48
8.4.6	MSSL Wide-Angle Laser Imager (WALI)	48
8.4.7	Executive	48
8.4.8	MMOPS	48
8.4.9	Science Assessment	48
8.4.10	Navigation	50
8.4.11	Vision Processing	51
9.	SCIENTIFIC EXPLOITATION	52
10.	INTERNAL TESTS LESSONS LEARNT	54
10.1	3D-TOF Areas for Further Improvement	54
10.2	AUPE-1 Areas for Further Improvement	54
10.2.1	Mechanical configurability	54
10.2.2	Field deployment	54
10.2.3	Auto exposure	55
10.2.4	Camera and filter specifications	55
10.3	HyperCam and WALI	56
10.3.1	Improvements	56
10.3.2	Potential continuation work	57
11.	APPENDIX 1: AU TESTS REPORT	58
1.	VERSION HISTORY	58
2.	ACTION SUMMARY	59
2.1	Participants	59
2.2	Venues	59
2.3	Timeline	60
3.	TESTING, DATA & PROCESSING	61
3.1	Test sequences	61
3.2	Data capture	61

3.3	Processed data	61
4.	PICTORIAL DOCUMENTATION	61
5.	SYSTEMS' STATUS.....	62
5.1	AUPE-2	62
5.2	iWAC	63
5.3	3D-TOF	63
5.4	iRover & Rover HW	64
5.5	iVision.....	64
5.6	iNav	65
5.7	iScience.....	66
5.8	Executive.....	67
5.9	Overseer & www I/F	67
5.10	Decision Module	67
5.11	Aerobot	67
5.12	WALI	68
5.13	Hypercam	68
5.14	Global DEM	68
5.15	PRoViM.....	68
	IMPLICATIONS FOR TENERIFE	70
6.	APPENDIX: BRIEF NOTES DURING MEETINGS & TESTING	70
	WED 2012-05-30	70
6.1	9:30: Briefing: PATLab.....	70
6.2	11:00 – 15:30 HW / SW in parallel.....	70
6.3	15:30 – 19:00 Workshop: Calibration	71
	THU 2012-05-31	71
6.4	9:00: Briefing / Preparation	71
6.5	10:00 – 12:00 Workshop.....	71
6.6	13:00 – 17:00 Field (mid – heavy rain & winds).....	72
6.7	Apart.....	72
	FRI 2012-06-01.....	72
6.8	9:00: Briefing / Preparation	72
6.9	11:00: Workshop / PatLab	73
6.10	16:00 – 22:00 Field (nice weather)	73
6.11	22:00 – 23:00 Workshop	73
	SAT 2012-06-02	73
6.12	9:00 – 18:30 Workshop	73
	SUN 2012-06-03.....	74
6.13	10:00 – 18:00 Hotel Four Seasons.....	74
	MON 2012-06-04	74
6.14	9:00 – 10:30 Patlab.....	74
6.15	11:00 – 19:00 Field.....	74
	TUE 2012-06-05	74
6.16	9:00 – 10:30 Patlab.....	74
6.17	10:00 – Workshop.....	74
	WED 2012-06-06	74
6.18	9:00 – 10:30 Patlab.....	74
6.19	11:00 – 16:30 Workshop	75
12.	APPENDIX 2: SYNTHETIC TEST DATA GENERATION	76
12.1	Simulation data generation	76
12.2	Preliminary tests using lab simulations.....	77
12.3	Synthetic rendered sequence description	79
13.	APPENDIX 3: IDRIS/AUPE CAMERA CALIBRATION DATA.....	81
14.	APPENDIX 4: EXAMPLE TEST-PLAN TIME AND AVAILABILITY CHART	86

Copyright: All texts, graphics and images are protected by copyright and may not be used without prior express approval.

This document does not represent the opinion of the European Community, and the European Community is not responsible for any use that might be made of its content. The research leading to these results has received funding from the European Community's Seventh Framework Programme (FP7/2007-2013) under grant agreement n° 241523 "PRoViScout".

