

Horizon 2020



Project title: AuTonomous intraLuminAl Surgery

Supervisory board reports 1

Deliverable number: D8.7

Version 1.0.0



Funded by the European Union's Horizon 2020 research and innovation programme under the Marie Skłodowska-Curie Grant Agreement No. 813782

Project Acronym: ATLAS
Project Full Title: AuTonomous intraLuminAI Surgery
Call: H2020-MSCA-ITN-2018
Grant Number: 813782
Project URL: <https://atlas-itn.eu>

Deliverable nature:	Report (R)
Dissemination level:	Public (PU)
Contractual Delivery Date:	March 31, 2020
Actual Delivery Date	April 19, 2020
Number of pages:	20
Keywords:	Supervisory Board Meetings, Meeting with Partners, Intro in ATLAS, planning of Secondments
Authors:	Gianni Borghesan, KUL
Peer review:	Emmanuel Vander Poorten, KUL

This deliverable summarizes ATLAS' Supervisory Board Meeting that was held over skype on March 2, 2020. This was the first meeting of the board. Partners were introduced into the project and got acquainted to each other. Opportunities for secondments were discussed. The midterm review meeting originally planned for May 2020 was briefly discussed as well.

Contents

1 Supervisory Board Meeting	3
1.1 Organisation and attendance	3
1.2 Detailed Meeting Minutes	3
1.3 Conclusion	5
2 Slides	6

List of Tables

1.1 List of attendees	3
---------------------------------	---

List of Acronyms

FBG	Fiber Bragg Grating
ESR	Early Stage Researcher
GA	General Assembly
NTA	Network-wide Training Activity
PCDP	Personal Career Development Plan
RTA	Researchers Training Activity
SB	Supervisory Board

1 Supervisory Board Meeting

1.1 Organisation and attendance

ATLAS's Supervisory Board (SB) meeting took place via Skype on March 2, 2020. All the beneficiaries attended the meeting and representatives of most of the partner institutes. Table 1.1 provides an overview of the attendance to the board meeting.

Table 1.1: List of attendees

Partner Organisations	Beneficiaries
Johan Vlekken (FBGS International)	Emmanuel Vander Poorten (KUL)
Leonardo De Mattos (IIT)	Mouloud Ourak (KUL)
Monica Vatteroni (EYE-TECH srl)	Gianni Borghesan (KUL)
Jules Scheltes (DEAM)	Alicia Casal (UPC)
Stamatia Giannarou (Imperial College)	Jenny Dankelman (TUDELFT)
Stefano Puliatti (OLV Robotic Surgery Institute)	Paul Breedveld (TUDELFT)
Anna Szkulmowska (AM2M)	Elena De Momi (POLIMI)
	Giancarlo Ferrigno (POLIMI)
	Benoit Rosa (UNISTRA)
	Paolo Fiorini (UNIVR)
	Diego Dall' Alba (UNIVR)
	Arianna Menciassi (SSSA)
	Selene Tognarelli (SSSA)

Meeting Objectives The purpose of the meeting was threefold :

- Introduction to the project for the Partner Institutions
- Acquaintance of the different parties
- Discussion on planning of secondments

The meeting was structured with the abovementioned objectives in mind. The detailed meeting minutes are provided in following section 1.2, the slides of the meeting are included in chapter 2.

1.2 Detailed Meeting Minutes

Description of the ATLAS project: The Project Coordinator described the project, starting from explanation of the targeted clinical scenarios and the associated challenges toward the research goals ATLAS is targeted. Then a presentation of the structure of the project itself was given. In particular information was given over the following items:

- the general framework of the Marie Curie Innovative training networks and the particular structure of the ATLAS project.

- the hiring results: a brief overview of the enrolled Early Stage Researchers (ESRs) and their main activities was given.
- the proposed Network-wide Training Activities (NTAs): project-wide training activities organised by the beneficiaries,
- the proposed Network-wide Training Activities (RTAs): these are project-wide training activities that are organised for the ESRs in order to strengthen the academical background and share knowledge amongst them,
- the planning of the PhD training and alignment with each ESRs perspective. This information is listed in the Personal Career Development Plans (PCDPs). The PCDPs entail both detailed research activities and plans per ESR as well as the envisioned secondments activities towards partners or beneficiaries, and lastly,
- the description of three integrated demonstrator projects to which the ESRs will work towards in a cross-institutional group. ATLAS identified three endoluminal scenarios in which we will explore developments for autonomous navigation, being:
 - Colonoscopy,
 - Ureteroscopy, and
 - Endovascular Catheterization.

Self introduction of the participants: Each participants introduced him/herself pointing out the field of expertise. The participants described the organisation they are affiliated with and their potential role in the ATLAS project. Each partner discussed the opportunities they had for hosting ESRs.

Secondments and roles of partners: Next we discussed the organization of secondments. Starting from the plan that was proposed in the General Assembly (GA) we considered how to implement the described actions and how to align these ambitions with the development plans of the ESRs.

The major comments are reported below:

- regarding visits to OLV Robotic Surgery Institute (ORSI). Given the facilities to test new technology and developments it was raised that it might be better to organise practical experiments with integrated systems at a later stage in the project when the technology is integrated. ORSI indicated that it could host small groups of 4 to 5 researchers, accommodating them over one or two weeks providing the facilities for preparing experiments during the day and conducting tests in the evening.
- Some ESRs have a number of secondments, whereby secondments are not in the same country, it was raised that these secondments ought to be planned carefully as to optimize. It was further argued that it would be advisable to align the secondments with the experience/need of the ESRs that were hired and align it closely with the focus of each ESRs key research line.
- SSSA already concluded the planning of the secondments within the PCDP and is making practical arrangements with the partners:
 - ESR 2 (Hasan Dad Ansari Mohammad): IIT (Sept/Oct 2020); ICSTM (Feb/March 2020); Endo-CAS (Beginning of 2022)
 - ESR 4 (Sujit Sahu): ICSTM (end of 2020); EyeTech (mid 2021); OLV Robotic Surgery Institute (Feb-March 2022)
- TUDELFT is arranging the secondment of ESR 1 (Fabian Trauzettel) with DEAM.
- FBGS will be hosting ESR 3 (Xuan Thao Ha).
- UPC expressed the desire to have ESR 10 (Martina Finocchiaro) visit INRIA (not participating to the call), in addition of other secondments, or in place of another.
- a further elaboration of the secondment plan is foreseen in the period following upon the SB.

Note - COVID-19 Due to COVID-19, secondment plans that were anticipated to take place in the spring of 2020 will be postponed until a later date.

Capita selecta The partners were then asked whether they are available to provide *capita selecta* lectures to the ESRs in the context of the RTAs. The purpose of the *capita selecta* is to bring the ESRs in contact with experts in the field

either from the clinic or industrial side who share their experience and know-how on topics that are closely related to ATAS technology. Such lectures will be held online. All the ESRs are warmly invited to actively participate to these meetings.

Some partners already proposed a number of concrete ideas on what they could present:

- **FBGS:** can present the working principles of Fiber Bragg Grating (FBG) technology, and its applications.
- **DEAM:** can present the activities of DEAM.
- **IIT:** can present an overview of IIT activities, as well as the activities carried out in the context of the European project μ RALPH.



The other partners participating to the call showed willingness to participate but will propose concrete ideas at a later stage.

1.3 Conclusion

The first SB meeting went smooth and amical. Partners showed great interest into the project and were keen to contribute. In follow-up efforts arrangements for the secondments will be further finalised. The date for a follow-up SB meeting will be determined after the upcoming intermediate review meeting while discussing with the Project Officer.

2 Slides

This chapter contains the slides that were used during the introduction of the project.


 

Supervisory Board Meeting – Introduction to ATLAS

E. Vander Poorten, G. Borghesan


Outline

- Intro in the project
- Acquaintance - Introduction of beneficiaries partners
- Input on
 - Capita selecta ?
 - Secondments ?
- Questions & Answers

2 

ATLAS – What ?

Call: H2020-MSCA-ITN-2018	https://atlas-itn.eu/
Type of Action: MSCA-ITN-EJD	
Acronym: ATLAS	twitter@AtlasItn
Current Phase: Grant Management	
Number: 813782	
Duration: 48 months	
GA based on the: H2020 MGA MSCA-ITN — Multi - 5.0	
Start Date: 01 Apr 2019	
Estimated Project Cost: €3,944,508.84	
Requested EU Contribution: €3,944,508.84	
Contact: Maria VILI	

3 

ATLAS – Why ?


4



ATLAS – Why ?

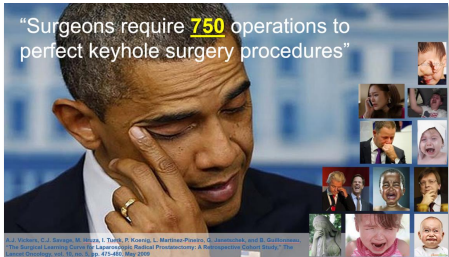
MIS (Minimal Invasive Surgery)

“Less” Invasive +




Long Learning Curve

“Surgeons require **750** operations to perfect keyhole surgery procedures”



5



ATLAS – Why ?

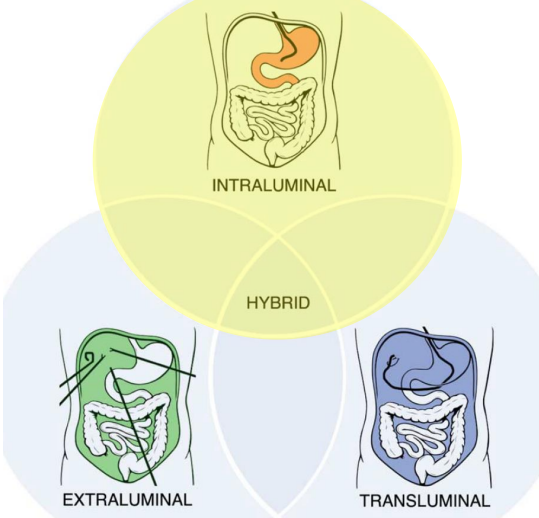
MIS (Minimal Invasive Surgery)

“Less” Invasive +


SPA (Single Port Access Surgery)

- through natural incisions
- and then through natural lumens

Vitiello, V., Lee, S. L., Cundy, T. P., & Yang, G. Z. (2012). Emerging robotic platforms for minimally invasive surgery. *IEEE reviews in biomedical engineering*, 6, 111-126.



6



ATLAS – Why ?

MIS (Minimal Invasive Surgery)
↓
“Less” Invasive +
↓
SPA (Single Port Access Surgery)
↓
“Less” than “Less” Invasive ++

Creepy Learning Curve

The diagram illustrates the evolution of surgical techniques. It starts with MIS (Minimal Invasive Surgery), which is described as “Less” Invasive (indicated by a single green plus sign). This leads to SPA (Single Port Access Surgery), which is described as “Less” than “Less” Invasive (indicated by two green plus signs). To the right, a graph shows a “Creepy Learning Curve” with a red line that starts flat and then curves sharply upwards. Three stick figures are shown at different points on the curve: one on the flat part, one on the beginning of the curve, and one near the top of the curve.

7

ATLAS – Why ?

Benefit robotics : reduced learning curve

“Proven”

INTRALUMINAL

Can we do this here too ?

8

The slide compares two surgical approaches. On the left, a photograph shows a laparoscopic procedure with the caption “Proven”. On the right, a diagram of the human torso shows the stomach and intestines with the caption “INTRALUMINAL” and the question “Can we do this here too?”. A double-headed blue arrow connects the two images.

ATLAS – Why ?

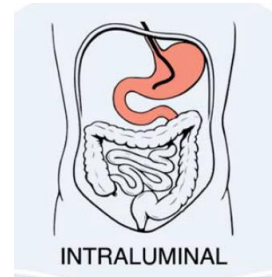
Towards the Da Vinci of Intraluminal Surgery
... but then the TESLA (autonomous) version ...

9

The slide features the ATLAS logo, which consists of a stylized white robot head icon and the word “ATLAS” in a white serif font, set against a dark blue rectangular background.

ATLAS – How ?

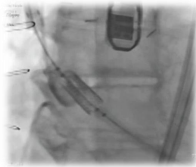
Key observation : similarities across intraluminal procedures



10

 ATLAS

ATLAS – Vision

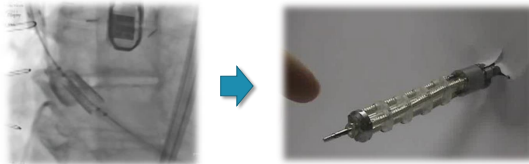


CASCADE
Cognitive Autonomous Catheters operating in Dynamic Environments

11

 ATLAS

ATLAS – Vision

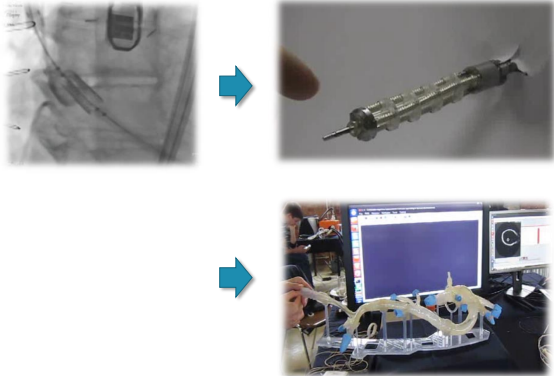


CASCADE
Cognitive Autonomous Catheters operating in Dynamic Environments

12

 ATLAS

ATLAS – Vision



Imperial College London
The Hamlyn Centre
for Robotic Surgery

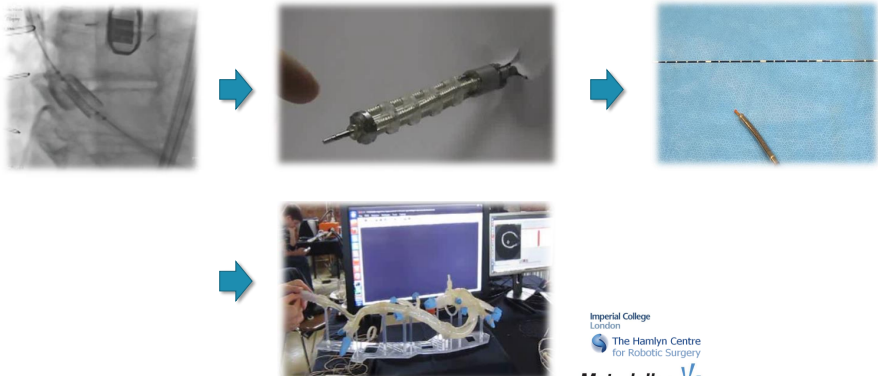
Materialise
Innovators you can count on

CASCADE
Cognitive Autonomous Catheters operating in Dynamic Environments

13

ATLAS

ATLAS – Vision



Imperial College London
The Hamlyn Centre
for Robotic Surgery

Materialise
Innovators you can count on


CASCADE
Cognitive Autonomous Catheters operating in Dynamic Environments

14

ATLAS

ATLAS – How ?

- Key observation: similarities across intraluminal procedures



C1 : Colonoscopy Gastroscopy

C2 : Ureteroscopy

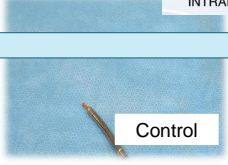
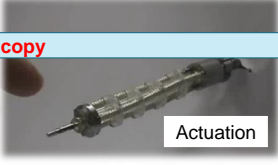
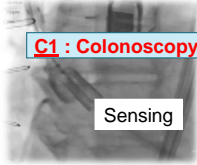

C3 : Endovascular Catheterization

15

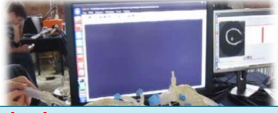
ATLAS

ATLAS – How ?


- Key observation: similarities across intraluminal procedures



C1 : Colonoscopy Gastroscopy




C2 : Ureteroscopy



C3 : Endovascular Catheterization

Modelling

16



ATLAS – How ?

- Key observation: similarities across intraluminal procedures
- Cross fertilization between experts ...




17




ATLAS – How ?

- Key observation: similarities across intraluminal procedures
- Cross fertilization between experts ...

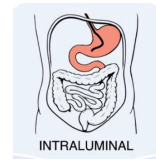


18



ATLAS – How ?

- Key observation: similarities across intraluminal procedures
- Cross fertilization between experts ...
- 3 steps :

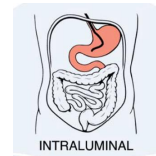


19



ATLAS – How ?

- Key observation: similarities across intraluminal procedures
- Cross fertilization between experts ...
- 3 steps :
 - step 1) Hiring --- 15 ESRs

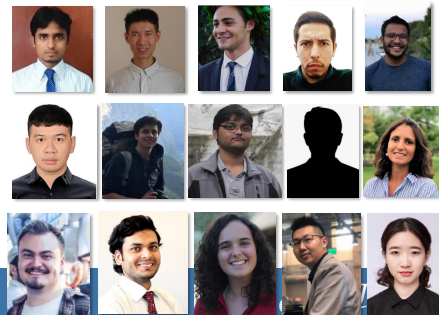
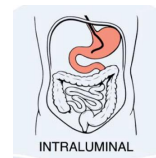


20



ATLAS – How ?

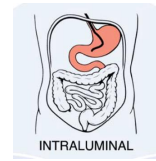
- Key observation: similarities across intraluminal procedures
- Cross fertilization between experts ...
- 3 steps :
 - step 1) Hiring --- 15 ESRs



21

ATLAS – How ?

- Key observation: similarities across intraluminal procedures
- Cross fertilization between experts ...
- 3 steps :
 - step 1) Hiring --- 15 ESRs
 - step 2) Training



22



ATLAS – How ?

- Key observation: similarities across intraluminal procedures
- Cross fertilization between experts ...
- 3 steps :
 - step 1) Hiring --- 15 ESRs
 - step 2) Training



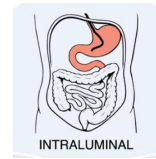
Network-wide Training Activity	PrM ²	Involved CoE's	TO
NTA1 <i>Medical Device Development and Translation</i> : One-week course on workflow analysis, clinical need assessment, device development controls, tech transfer, good manufacturing and clinical practices, in close collaboration with IRCAD.	6, 12, 18	UNISTRA, UPC	TO1
NTA2 <i>Sensing and actuation for soft robotics</i> : Three-day course introducing methods for designing, manufacturing and integrating sensing and actuation in soft robots, hands-on building of common ATLAS research platforms.	6, 12, 18	TUDELFT, SSSA, KUL	TO2
NTA3 <i>Best integration practices and robotic middleware</i> : One-week course offering basics of data-acquisition, ROS, visualisation tools, introducing C5 for lean software development and integration, hands-on control of common ATLAS platforms.	6, 15	KUL, UNIVR, UPC	TO3
NTA4 <i>3D intraluminal modelling</i> : One-week course in pre- and intra-operative techniques for registering, segmenting and reconstructing rigid and deformable anatomies.	12, 24	POLIMI UNIVR	TO3
NTA5 <i>ATLAS session at CRAS</i> : ESRs will present their latest developments at CRAS.	12, 24	SSSA, KUL, POLIMI UNIVR	TO4
NTA6 <i>Hands-on ATLAS session at Summer School of Cognitive Surgical Robotics (COSUR)</i> : hands-on actuation, sensing, modelling and integration for soft robotics.	10, 34	UNIVR, SSSA, TUDELFT, KUL	TO4
NTA7 <i>Soft skills for soft robotics</i> : gender aspects, research integrity, ethic issues, preparing ethical approval for validating assistive technology, open access, data management.	12, 24, 36	UPC, UNIVR, UNISTRA	TO5
NTA8 <i>Tech transfer for SR</i> : Course on managing IPR and entrepreneurship, grant writing.	24, 42	POLIMI UNIVR, KUL, UNISTRA, TUDELFT	TO5

23



ATLAS – How ?

- Key observation: similarities across intraluminal procedures
- Cross fertilization between experts ...
- 3 steps :
 - step 1) Hiring --- 15 ESRs
 - step 2) Training



Training Activity	Objective
RTA3 Master thesis guidance	Each ESR will be involved in guiding a master thesis at another beneficiary institute, together with a local ESR that provide local guidance.
RTA4 Review of scientific papers	ESRs will team up with an ESR from another institute to conduct at least two reviews of international peer-reviewed scientific papers. ESR's advisors will provide feedback on the conducted review. Before submitting original ATLAS work, other ESRs will be asked to proofread and comment. This will prepare ESRs for future R&D positions by promoting critical thinking. It will also increase the overall impact and collaboration of ATLAS through a better understanding of each other's work.

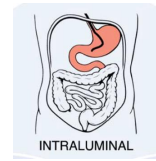
Training Activity	Objective	Implementation
RTA1 Capita Selecta	A delegate from industry (e.g. partner) or alternatively representative of the clinical field provides a talk on a selected topic relevant for ATLAS. One ESR is made responsible for introducing the talk and for moderating the discussion.	video-conferencing
RTA2 Journal club	Two ESRs introduce a seminal work within their domain to the other ESRs. One ESR moderates the discussion and gathers feedback.	Video-conferencing

24



ATLAS – How ?

- Key observation: similarities across intraluminal procedures
- Cross fertilization between experts ...
- 3 steps :
 - step 1) Hiring --- 15 ESRs
 - step 2) Training **by research**



25

ATLAS

ATLAS Beneficiaries



POLITECNICO
MILANO 1863

UNIVERSITAT POLITÈCNICA
DE CATALUNYA
BARCELONATECH



UNIVERSITÀ
di VERONA

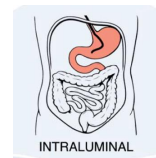


26

ATLAS

ATLAS – How ?

- Key observation: similarities across intraluminal procedures
- Cross fertilization between experts ...
- 3 steps :
 - step 1) Hiring --- 15 ESRs
 - step 2) Training **by secondments**



27

ATLAS

ATLAS Beneficiaries

ATLAS Partners

- Institut De Recherche Contre Les Cancers De L'appareil Digestif
- Olv Robotic Surgery Institute
- Fundacio Hospital Universitari Vall D'hebron - Institut De Recerca
- Istituto Europeo Di Oncologia Srl
- Institut National de Recherche en Informatique et Automatique (INRIA)
- Fondazione Istituto Italiano Di Tecnologia (IIT)
- Imperial College Of Science, Technology And Medicine
- Deam
- Fbgs International N.V.
- Eye-Tech
- Camelot Biomedical Systems Srl
- Orobix Srl
- Endocas- Università Di Pisa
- AM2M Spolkaz ograniczona odpowiedzialnoscia spolka komandytow

28

ATLAS – How ?

- Key observation: similarities across intraluminal procedures
- Cross fertilization between experts ...
- 3 steps :
 - step 1) Hiring --- 15 ESRs
 - step 2) Training
 - step 3) Collaborating

29

ATLAS – Collaborating Across Applications

	Actuation	Sensing	Modeling	Control		
C1 : Colonoscopy Gastroscopy						◇ D5.2
C2 : Ureteroscopy						◇ D5.3
C3 : Endovascular Catheterization						◇ D5.4

30



ATLAS Integration projects

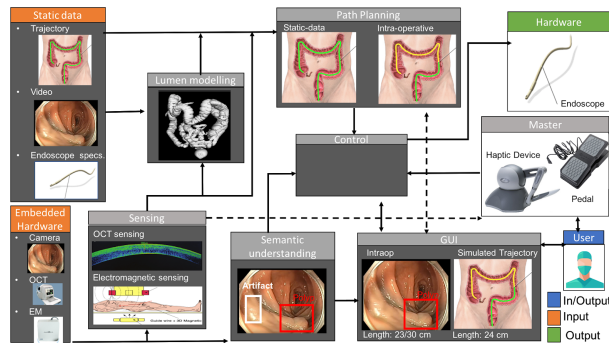
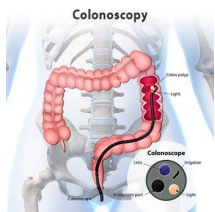
- C1:** Ameya Pore, *Fernando Herrera*, Guiqiu Liao, Luca Sestini, Sujit Sahu
- C2:** Chun-Feng Lai, Jorge Lazo, Martina Finocchiaro, Sanat Ramesh, Xuan Thao Ha
- C3:** Beatriz Farola Barata, Di Wu, Fabian Trauzettel, Mohammad Hasan Dad Ansari, Zhen Li

Colonoscopy scenario group (C1)

Colorectal cancer ranks third among the most common cancer. Colonoscopic procedures are used to detect gastrointestinal diseases such as peptic ulcers. We consider the task of autonomous navigation and target-re-identification for a colonoscopic procedure. During diagnostic colonoscopy or surgical intervention such as polyp removal, after possible targets identification by the surgeon (from endoscopic video), the endoscope is often extracted and reinserted, requiring target re-identification. In the project, we provide an intra-operative framework for re-reaching a previously identified target.

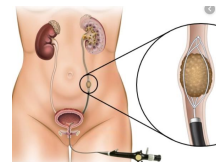
Challenges:

- Colon is highly deformable
- Endoscope interacts with colon variably

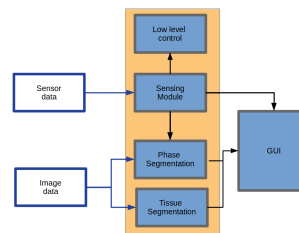


Ureteroscopy scenario group (C2)

Urolithiasis or kidney stones disease are crystalline aggregates of one or more components, most commonly calcium oxalate, uric acid, struvite or cystine. Urinary calculi may occur anywhere in the urinary tract but it is more common to appear in the kidneys.



Our proposed ureteroscopy system consists of four modules: low-level control, sensing, phase segmentation, and tissue segmentation. The system expects external input modules for image, sensor, and path planning. Furthermore, an external GUI module for visualization and user interface is a requirement for our system. GUI will receive information from sensing module, phase segmentation and tissue segmentation module.



Endovascular Catheterization scenario group (C3)

Chronic total occlusion: A complete occlusion in the coronary arteries for more than 3 months

Current treatment approach

A. The 4 Hybrid Strategies Applied in CTO-PCI

Clinical need

- Stability of the catheter placement: When the guidewire is pushed, it tends to knock the catheter out of the coronary artery
- Safe navigation of guidewire from antegrade side to retrograde side (or vice versa) without perforating the artery wall

What do we plan?

- To design a larger module to be anchored at the entrance of coronary arteries
- The larger module can have smaller lumens running through its length for different functionalities (microcaths, guidewires, IVUS probes)
- Magnetically orienting the guidewires/microcath
- IVUS probe for intravascular imaging in order to produce a 3D reconstructed model of the lumen (and provide a navigation map)
- Autonomous path planning

Schematic of the modules composing the system

Acquaintance - Introduction of beneficiaries partners

Secondments

Secondments

Table 5 – Training activities and secondments to clinical partners (■) R&D institutes (■) and companies (■)

Beneficiaries	No. of ESRs enrolled	No. of ESRs as secondary institute	NTA event number per subsection 1.2.2. participating as organizer or as co-organizer	Secondment, ESR# per lead benef.	Partners														
					IRCAD	ORSI	VHIR	IEO	INRIA	IT	Hamlyn	DEAM	FBGS	EYE-TECH	Camelot	OROBIX	EndoCAS	AM2M	
KUL	3	3	2,3,5,6,8		5	3			11	11	5	3	3					11	5
UNIVR	2	2	3,4,5,6,7,8		9									9,15	9,15				
POLIMI	2	2	4,5,8	6,13										13			13		
UNISTRA	3	3	1,7,8		8	7,8,14	14									8	7,14	7	
SSSA	2	2	2,5,6		2	4		2	2				4						
TUDELFT	2	2	2,6,8		1	12			12	1									
UPC	1	1	1,3,7		10	10	10							10					

37

Secondments

38

Capita Selecta

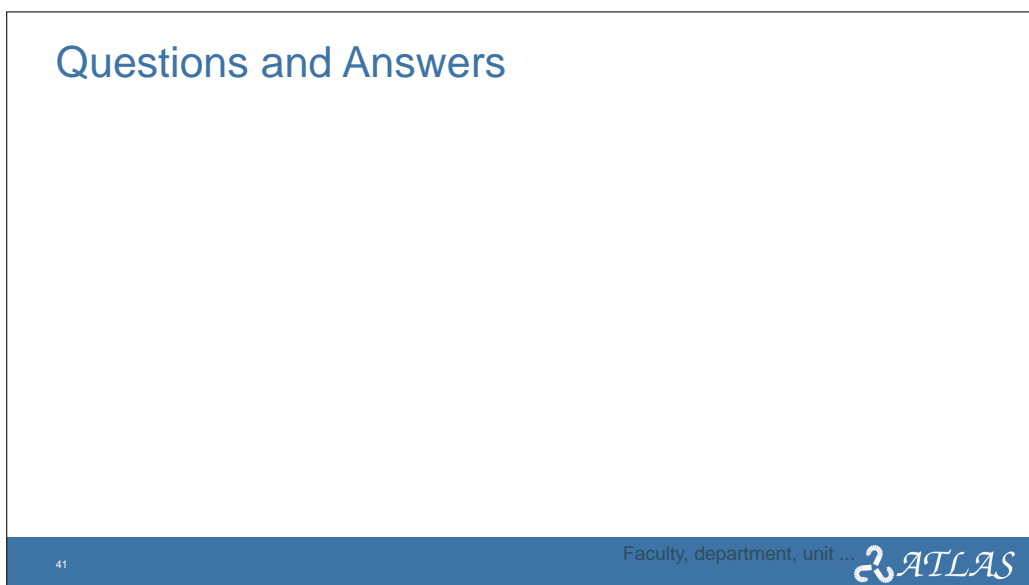
Training Activity	Objective	Implementation
RTA1	Capita Selecta A delegate from industry (e.g. partner) or alternatively representative of the clinical field provides a talk on a selected topic relevant for ATLAS. One ESR is made responsible for introducing the talk and for moderating the discussion.	video-conferencing
RTA2	Journal club Two ESRs introduce a seminal work within their domain to the other ESRs. One ESR moderates the discussion and gathers feedback.	Video-conferencing

39




40

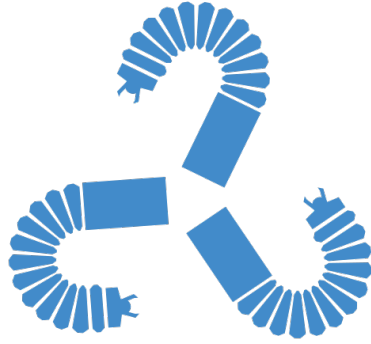
Faculty, department, unit ...



41

Faculty, department, unit ...





The ATLAS project

last modified: April 19, 2020

ATLAS-D8.7-1.0.0

Horizon 2020