JOHANNES KEPLER
UNIVERSITY LINZ

ISSE

Software Engineering 2022W

E2: Use Case Analysis

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343.303

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343.309

Schedule

Topic	Date	Type	Lecturer
~~E1: Familiarize with Dronology~~	5-Oct-22	Individual	Wesley
E2: Use Case Analysis	**12-Oct-22**	Individual	**Luciano**
E3: Tracing Use Cases to EARS Requirements	19-Oct-22	Team	Cosmina
E4: Requirements Engineering Mission Planning	9-Nov-22	Individual	Wesley/Cosmina
E5: Define Architecture and Design	16-Nov-22	Team	Luciano
E6: Define Mission Planning Extension	30-Nov-22	Individual	Cosmina
E7: Mission Planning Cost Estimation	7-Dec-22	Individual	Wesley
E8: Quality Assurance	14-Dec-22	Team	Luciano
E9: Test Case Design	11-Jan-23	Individual	Wesley
E10: In-class exercise	18-Jan-23	Individual	Wesley

E2: Use Case Analysis

- Learning goal
  - Understand the functionality of Dronology;
  - Model the use cases and actors of the system;

- Input (available on moodle)
  - Dronology Dataset;
  - Use Case Paper;

- Output
  - Use Case diagram;

Goal

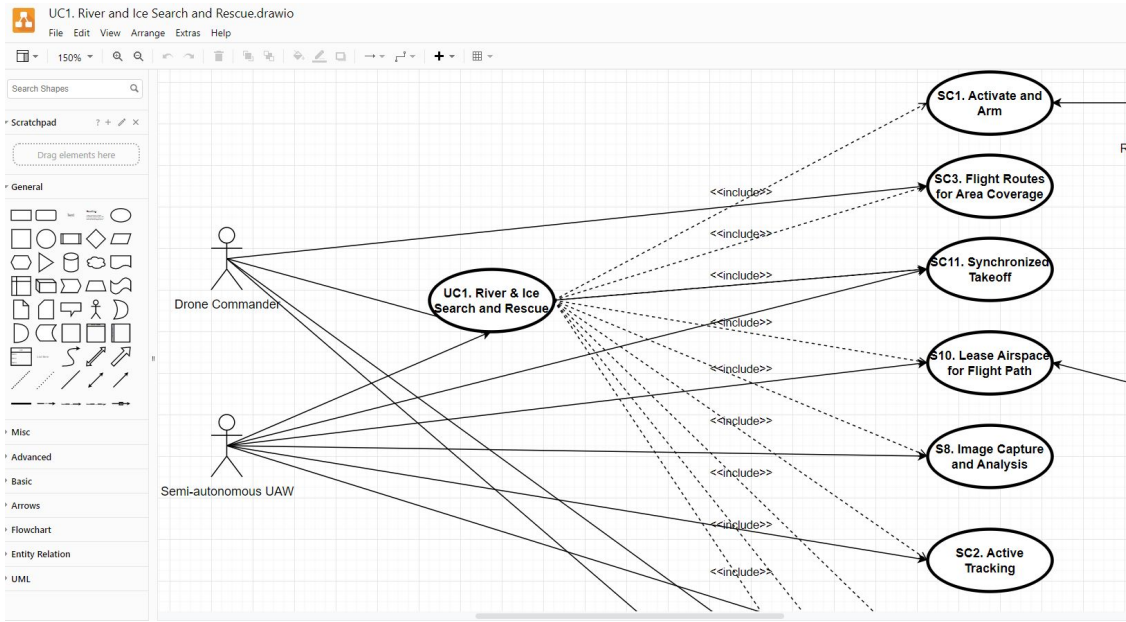
- **Each member** of the team must create **one use case diagram** from one of the use case scenarios (part of the dronology dataset on Moodle);

- Members of the **same group cannot** model the **same use cases**.

Tool

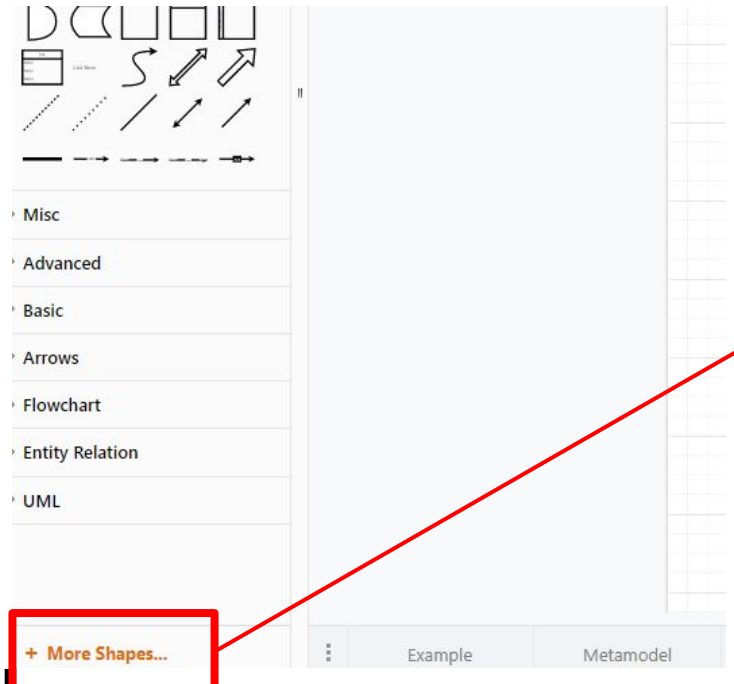
- Use case diagram(s) should be modeled using http://diagrams.net/

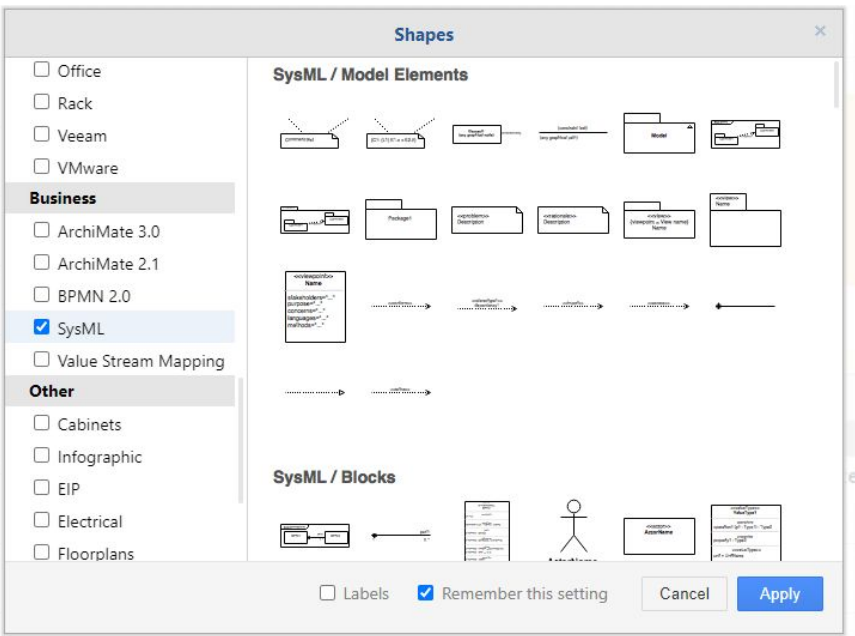
- Export the diagram as a PDF file;
  - File > Export as > PDF



Tool

- Make sure to use the SysML shapes
  - More Shapes > Business > SysML





Example

- Main use case

Use Case: River Search and Rescue	
ID	UC1
Description	Multiple UAVs dispatched to search for victim in river.
Primary Actor	Drone Commander (human)
Supporting Actors	Semi-autonomous UAV (UAV)
Stakeholders and Interests	Emergency responders, FAA regulators, public
Pre-Conditions	(1) DroneResponse is running, (2) Multiple UAVs with cameras, (3) Victim in river
Success end condition:	The victim is found by a UAV and actively tracked until rescued.
Failure end condition:	The victim is not found or the victim is found but not actively tracked.
Trigger	The Drone Commander activates the search.

	Main Success Scenario	Linked Use Case:
1	UAVs are placed in their launch positions.	
2	UAVs are activated and armed.	ActivateAndArm
3	Emergency responders initiate the dynamic generation of flight routes for the targeted area.	AreaCoverage
4	The DroneResponse commander issues a command to start the flight.	
5	The UAVs tasked with search perform synchronized takeoff.	
6	The UAVs lease airspace and fly their assigned flight routes.	LeaseAirspace
7	While flying their assigned routes, the UAVs perform image capture and oboard analysis.	ImageCapture
8	When a potential victim is detected by a UAV at a confidence level above [victim_detected] threshold a [victim_detection] event is raised.	
9	DroneResponse forwards the event to all UIs registered to receive victim_detection alerts.	
10	The UAVs coordinate their response and one is selected and switches to active tracking mode.	ActiveTracking
11	DroneResponse requests victim confirmation from the human operator.	VictimConfirm
12	The UAV receives confirmation from the human operator that the victim sighting is valid.	
13	DroneResponse automatically sends the GPS coordinates to the mobile_rescue system.	
14	A UAV tasked with delivering a flotation device performs item deliver	ItemDelivery
15	Human responders arrive at the scene.	
16	The Drone Commander end the flight.	EndFlight

Example

- Identifying Actors

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- Understanding the connection between main use case and supporting use cases

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Supporting Use Case: Activate and Arm	
ID	SC1
Description	The UAV is prepped for flight, activated by turning 'safety' off, and finally armed.
Primary Actor	RPIC - remote pilot in control (human), DroneResponse (system), Semi-autonomous UAVs (UAV)
Supporting Actors	Technicians
Stakeholders and Interests	General public
Pre-Conditions	UAV has prepped for flight and airworthy. Placed at launch position.
Success end condition:	The UAV passes arming checks and is armed for flight
Failure end condition:	The UAV takes off without adequate arming checks
Trigger	An arming command is issued

Main Success Scenario	
1	The RPIC deactivates the UAV's safety switch.
2	DroneResponse issues an arming command.
3	The UAV executes all prearming tests.
4	The UAV passes prearming tests.
5	The UAV arms.
6	The UAV's status is set to MISSION mode (PX4=MISSION, Ardupilot=GUIDED/STABILIZED)
7	The UAV's automated pilot notifies DroneResponse that the UAV is armed for flight.

Example

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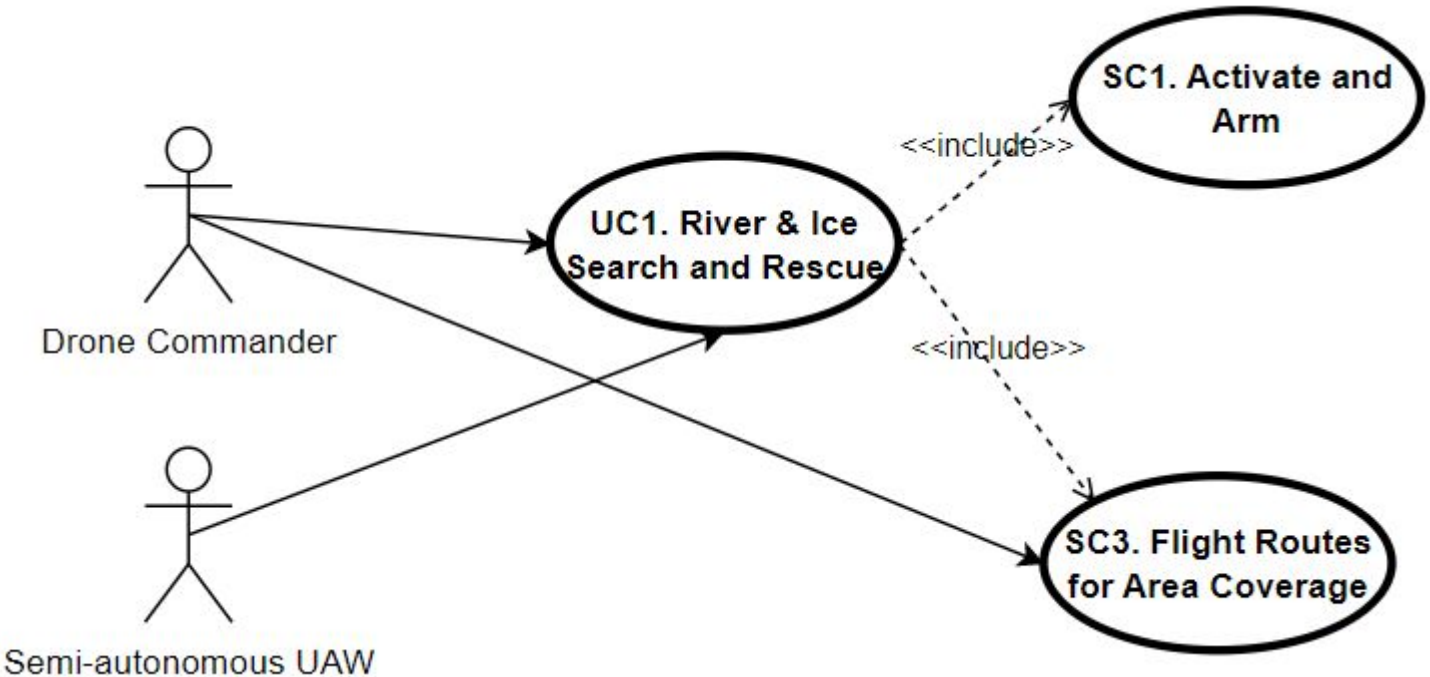
7	The UAV's automated pilot notifies DroneResponse that the UAV is armed for flight.

Supporting Use Case: Generate Flight Routes for Area Coverage	
ID	SC3
Description	Define a coverage area and allocate routes to UAV(s)
Primary Actor	Drone Commander (human), DroneResponse (system), Semi-autonomous UAV (UAV)
Supporting Actors	
Stakeholders and Interests	
Pre-Conditions	UAVs are active and armed, DroneResponse is active
Success end condition:	Search routes planned and allocated to UAVs for an efficient search.
Failure end condition:	Ineffective search routes provide low coverage or inefficient search
Trigger	User selects the option to mark a region and generate routes dynamically

	Main Success Scenario
1	The Drone Commander selects the feature to mark a region on the currently displayed map.
2	The Drone Commander marks a polygon shape on the map.
3	DroneResponse analyzes the shape and size of the drawn polygon for feasibility of generating routes and the polygon is accepted as viable for route generation.
4	The Drone Commander specifies the number of UAVs N that will participate in the mission.
5	DroneResponse dynamically generates an efficent set of N flight routes that optimize coverage of the marked area whilst minimizing flight times.
6	DroneResponse assigns the flight routes to N available UAVs.
7	The use case ends once flight routes have been generated and assigned.

Example

- Creating the diagram



Example

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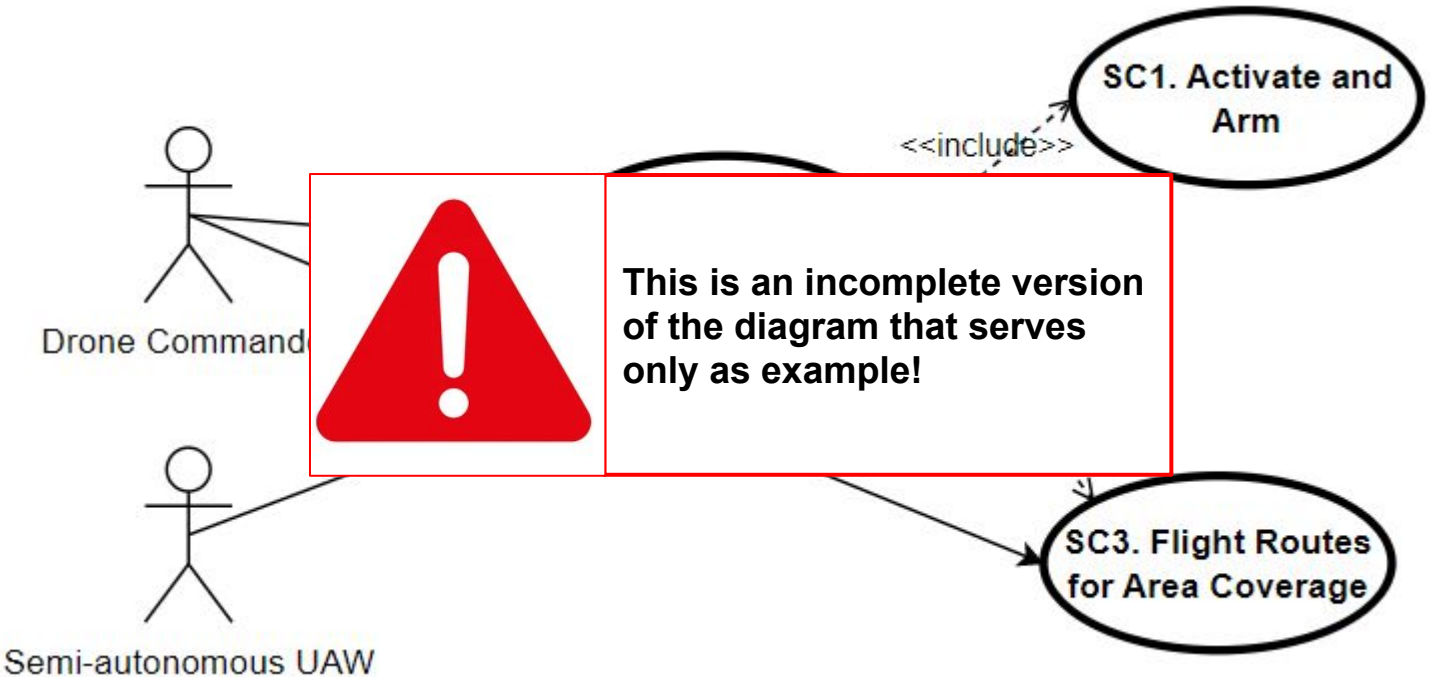

Hand-in Procedure and Grading Criteria

- Deadline: 18.10.2022 - 23:59
- Hand-in procedure
  - Use case diagram should be uploaded on Moodle as a PDF file.
  - Make sure to name the file with the following format:
  - *UCX_Use_Case_Name_StudentLastName_StudentFirstName.pdf* (Replace X for the number of the use case)
- Grading Criteria
  - **Correctness** - use the UML use case notation correctly
  - **Completeness -** no missing use cases or actors in the diagram