Firefighting UAV

Software Model in **RoboChart**

Matt Windsor, ECNU Summer School 2022

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why the Firefighting UAV?

large-scale robot verification task

complex hardware and software

multi-team, multi-site collaboration

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1. Cameras (thermal, depth, RGB)
2. Nozzle attached to gimbal
3. Arduino (pump/gimbal control)
4. Arm
5. Battery
6. Pump
7. Onboard computer
8. Water bag
9. UAV

hardware
(to be abstracted)

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software (planning flowchart)

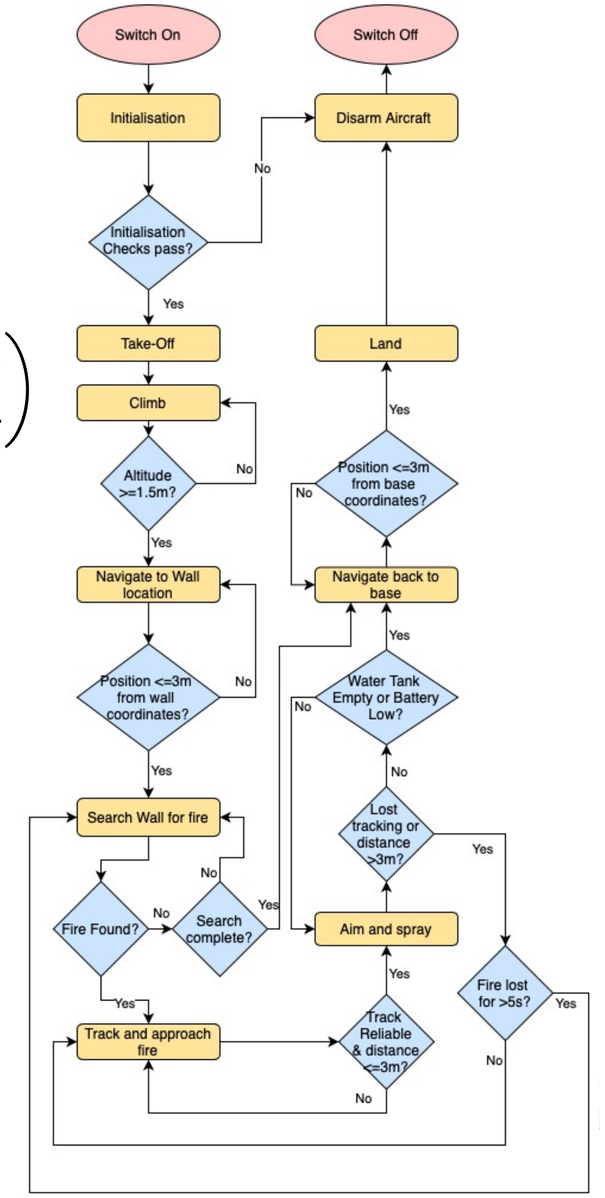
fly to wall

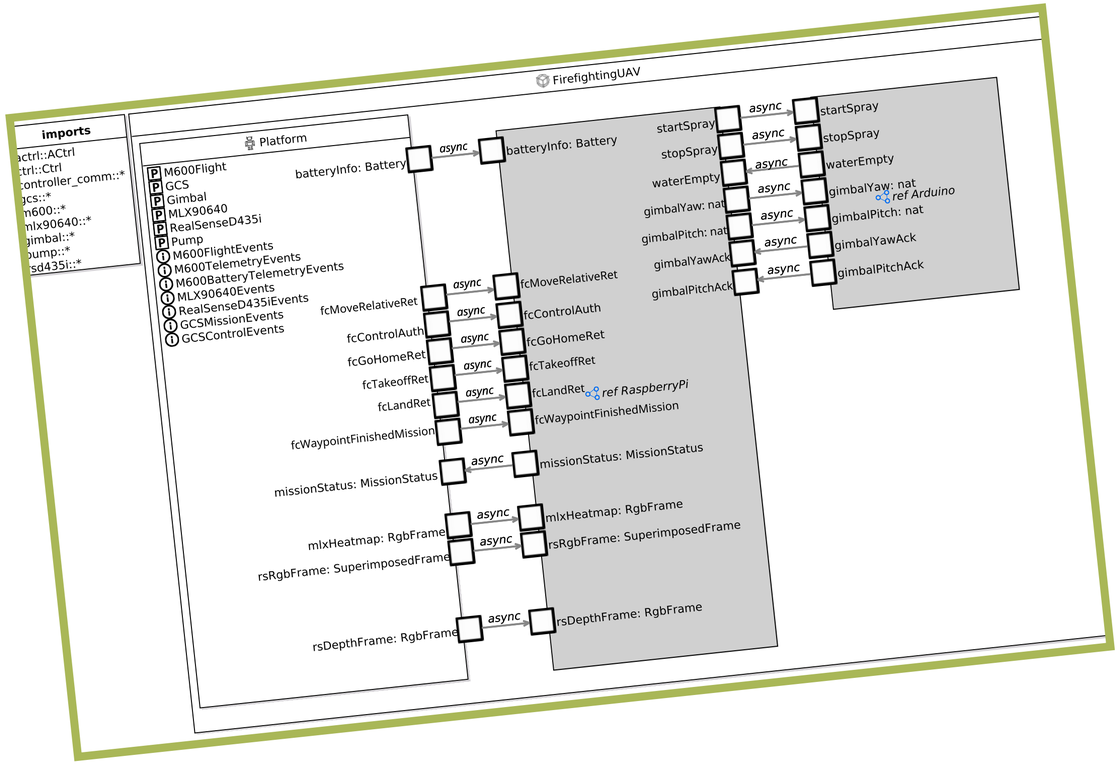
search wall in pattern

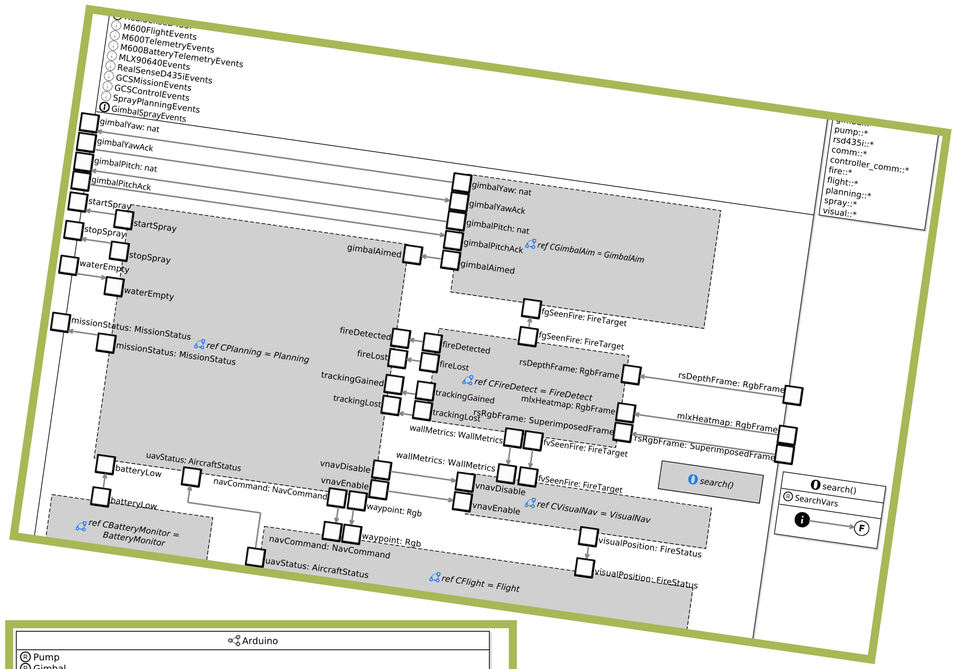
if fire detected: spray it

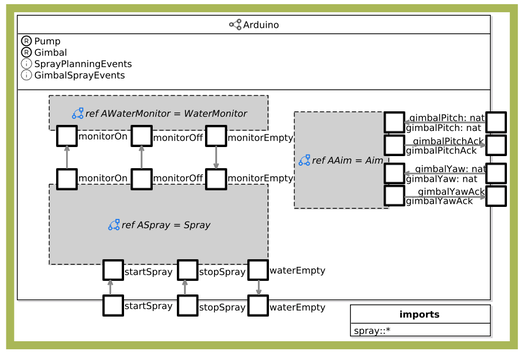
if fire lost, return to searching

when wall searched or out of resources: go home









goal

model of the UAV software design in **RoboChart**

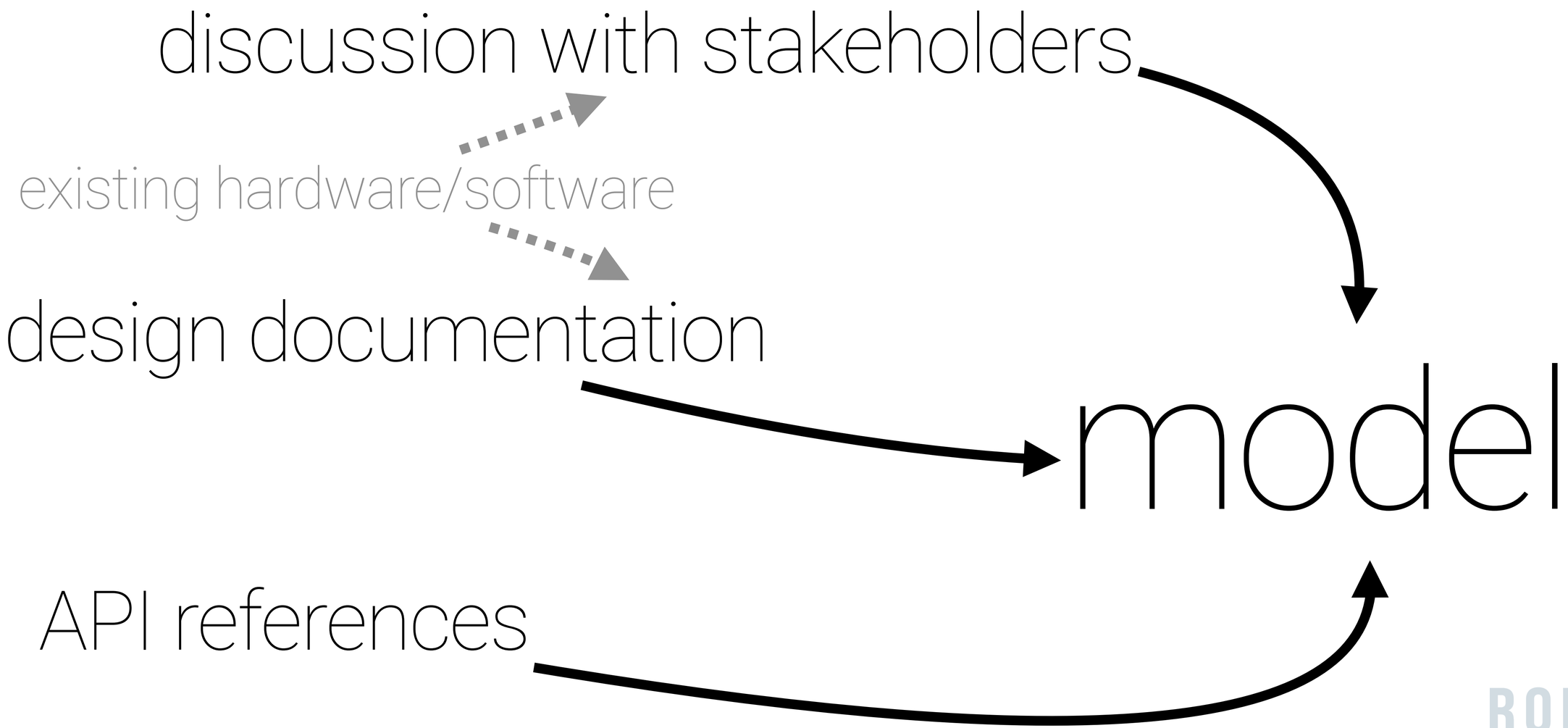
verification (eventually using **RoboCert**)

simulation (via **RoboSim**)

code generation

explicit record of decisions/ambiguities

...why **Robo**Chart?



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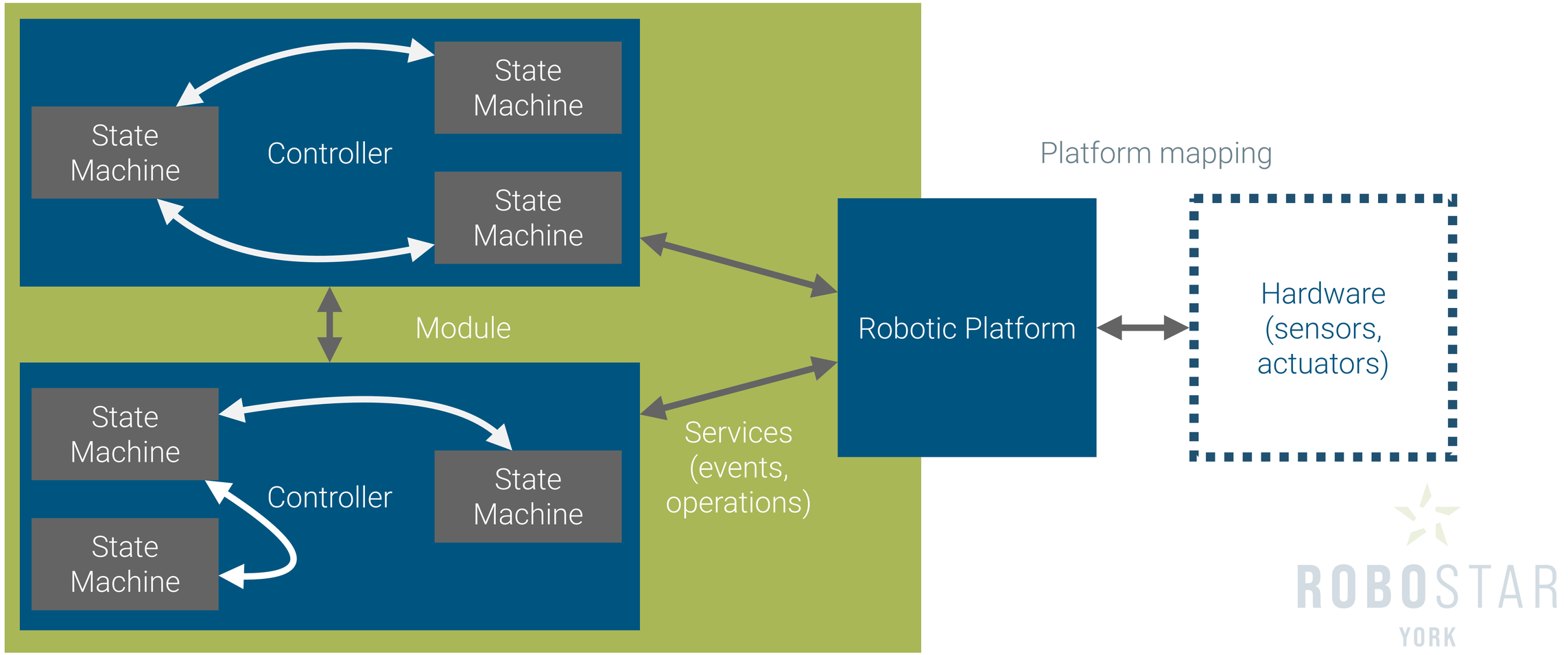
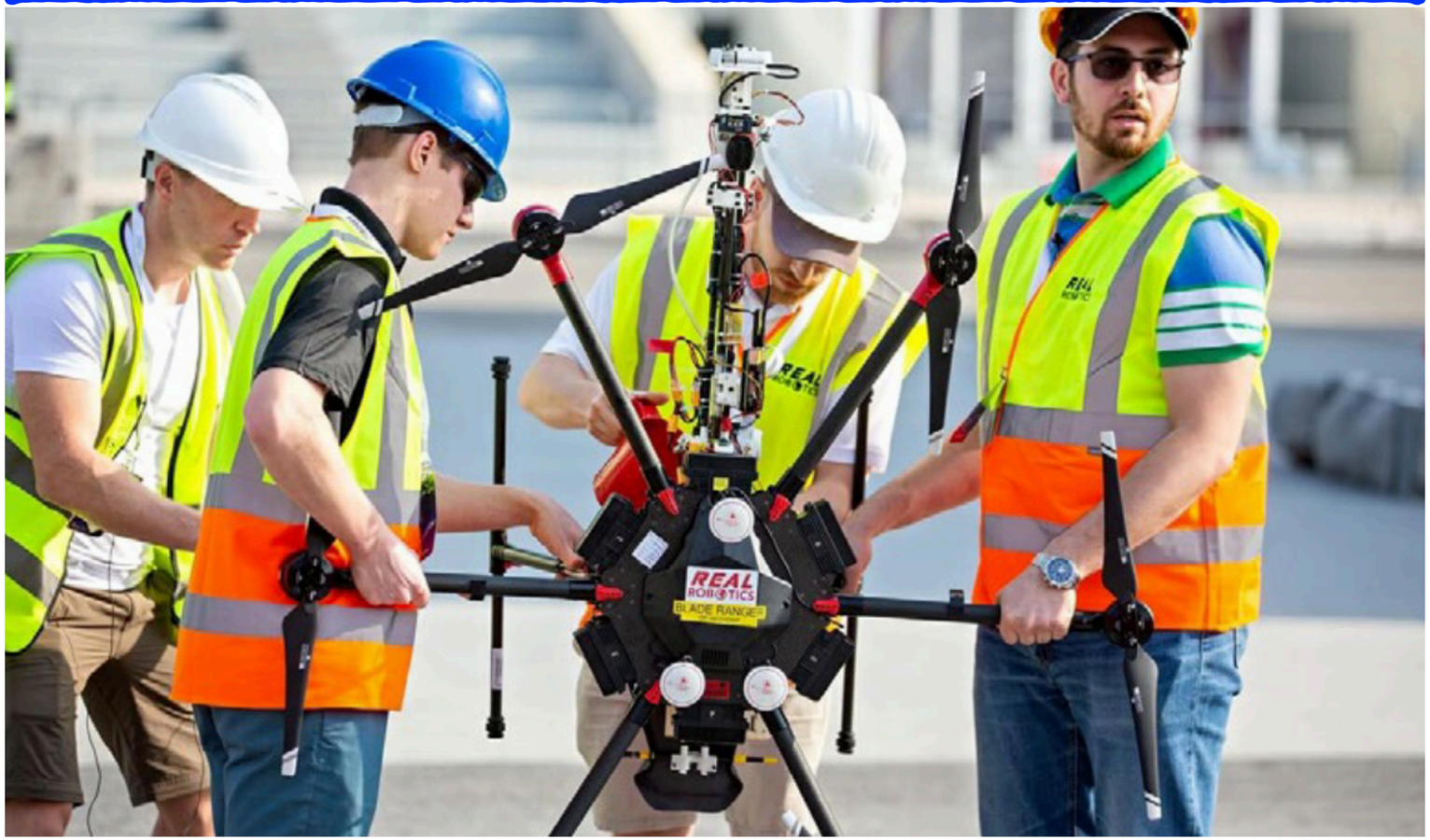
Starting the modelling process
RoboChart component model



Arduino: gimbal motor control, pump on/off, water level monitoring



NUC: high-level planning, computer vision, interfacing with flight control

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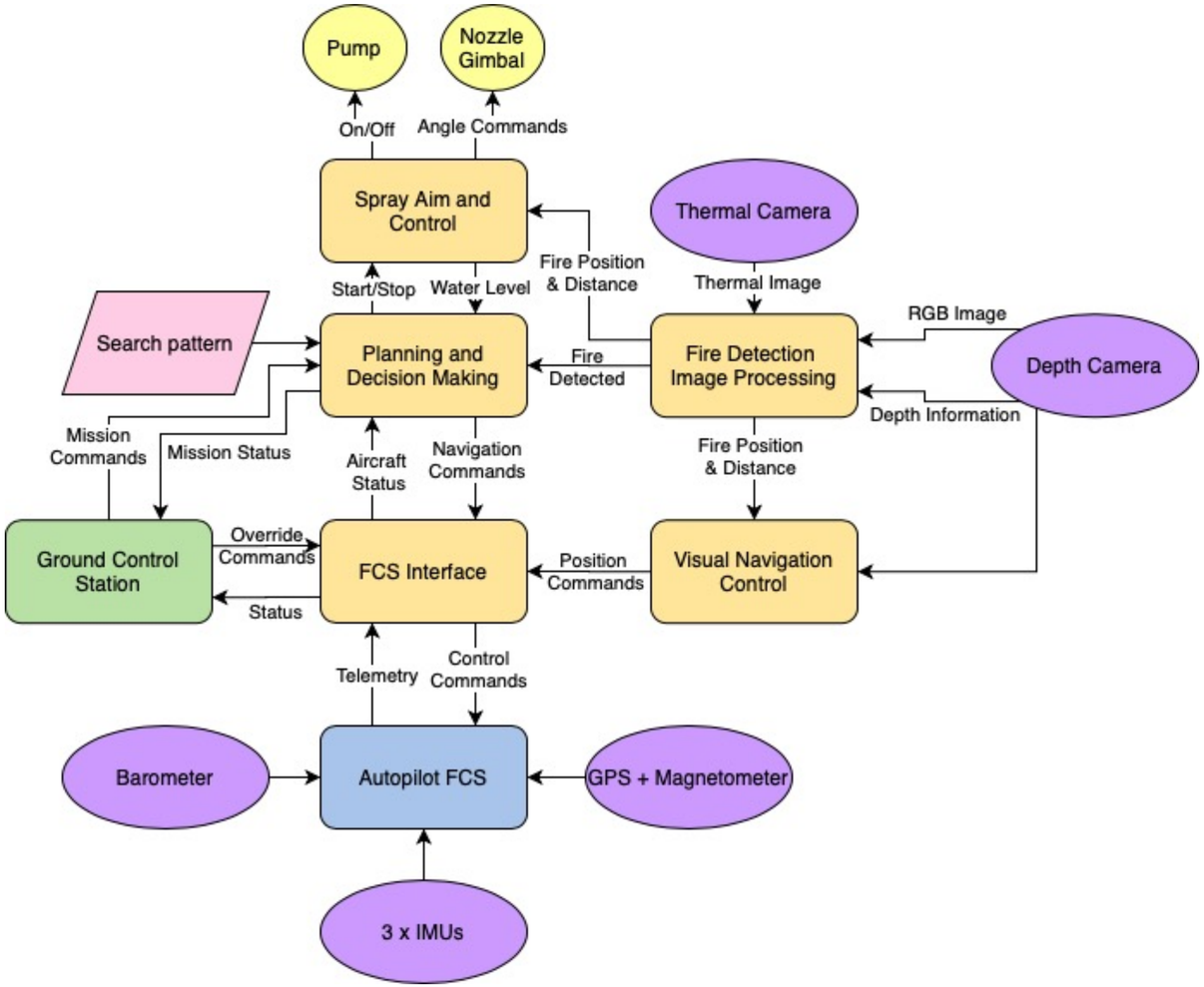
Documentation
High-level block diagram



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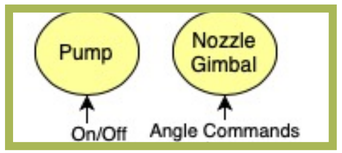
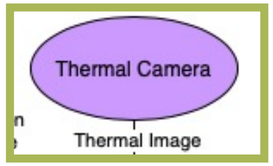
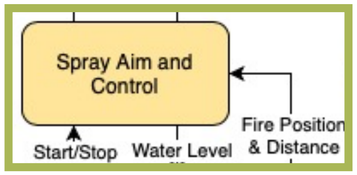
Documentation
High-level block diagram



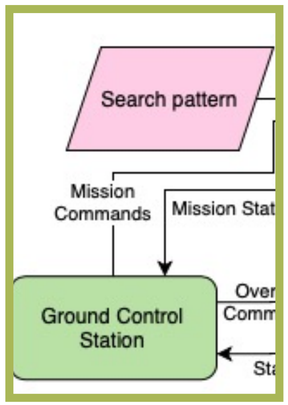
Arduino-bound hardware

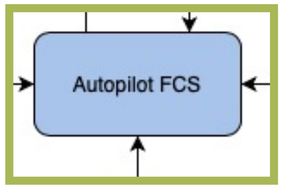


NUC-bound hardware



Software task





Miscellaneous (modelled as software or hardware)

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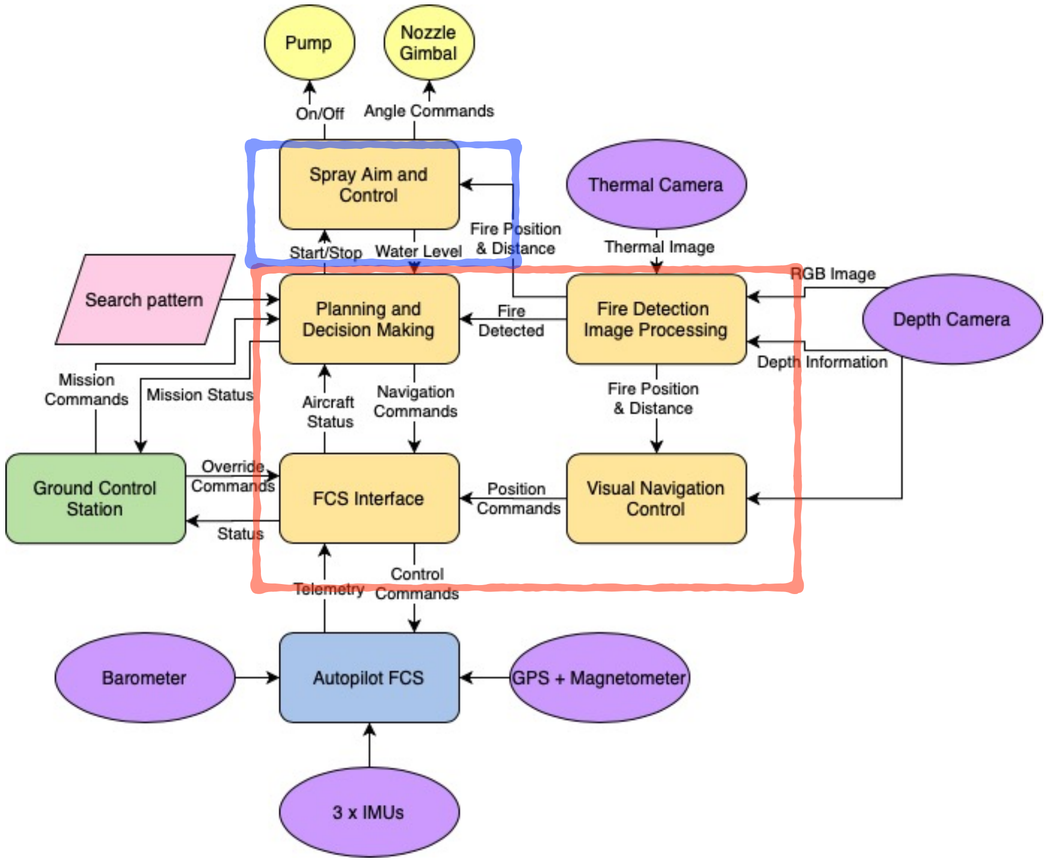
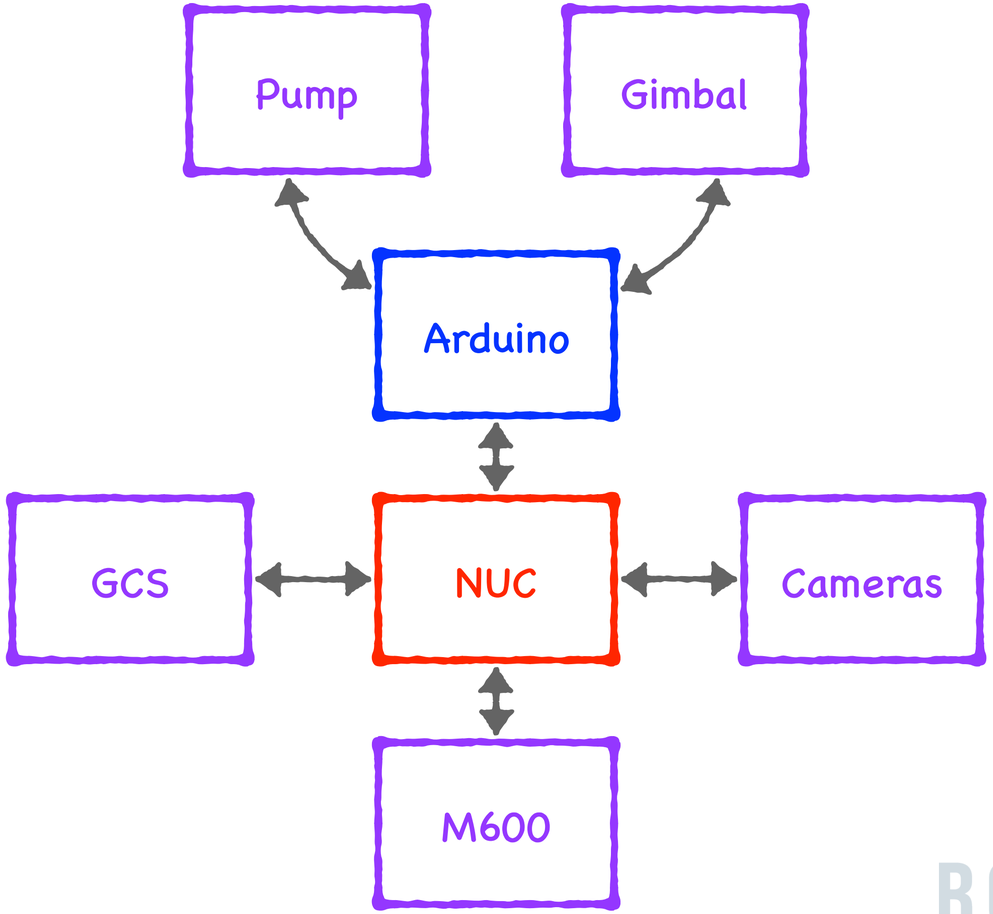
Starting the modelling process
Finding the controllers





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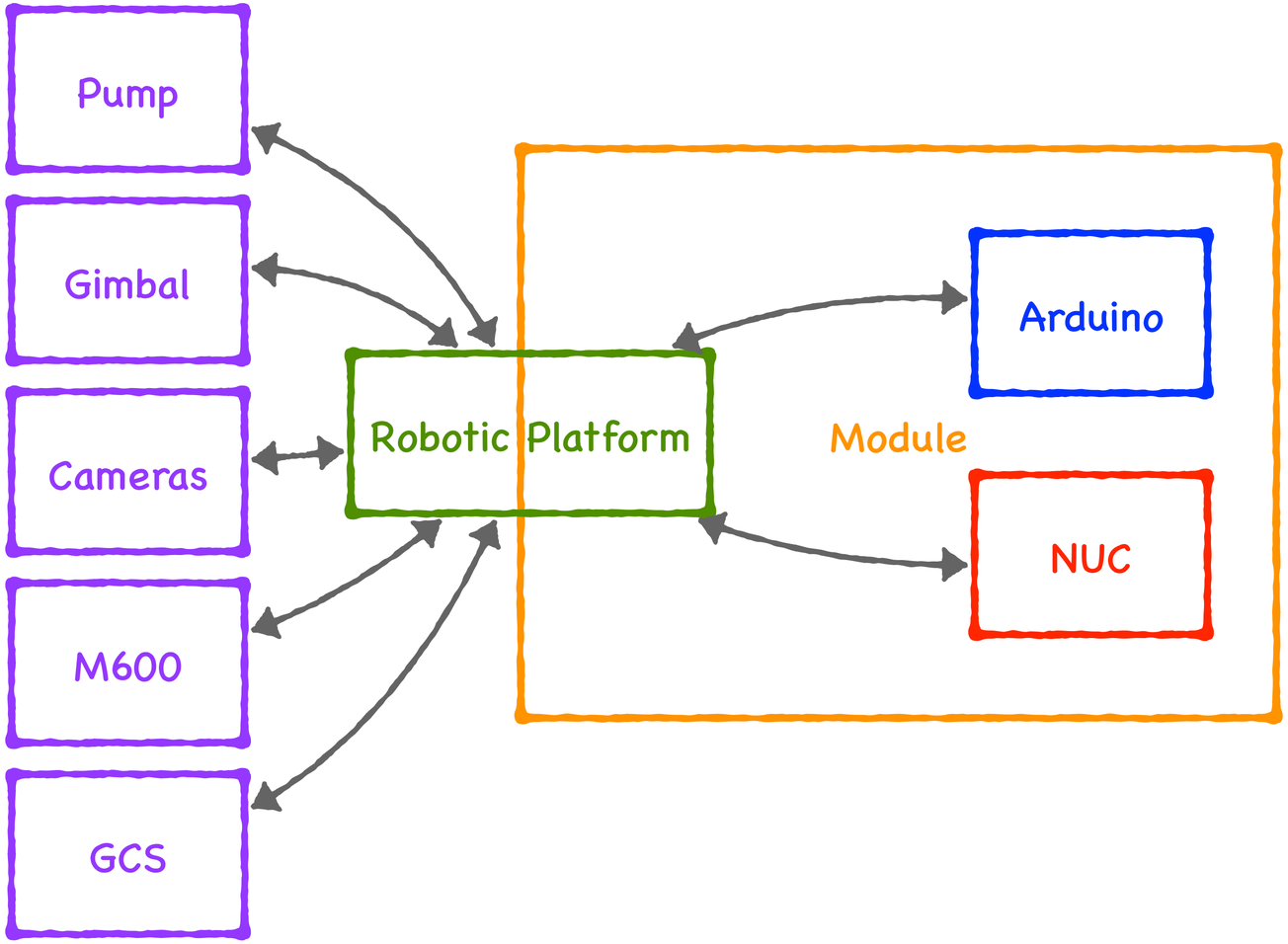
Starting the modelling process
High-level overview



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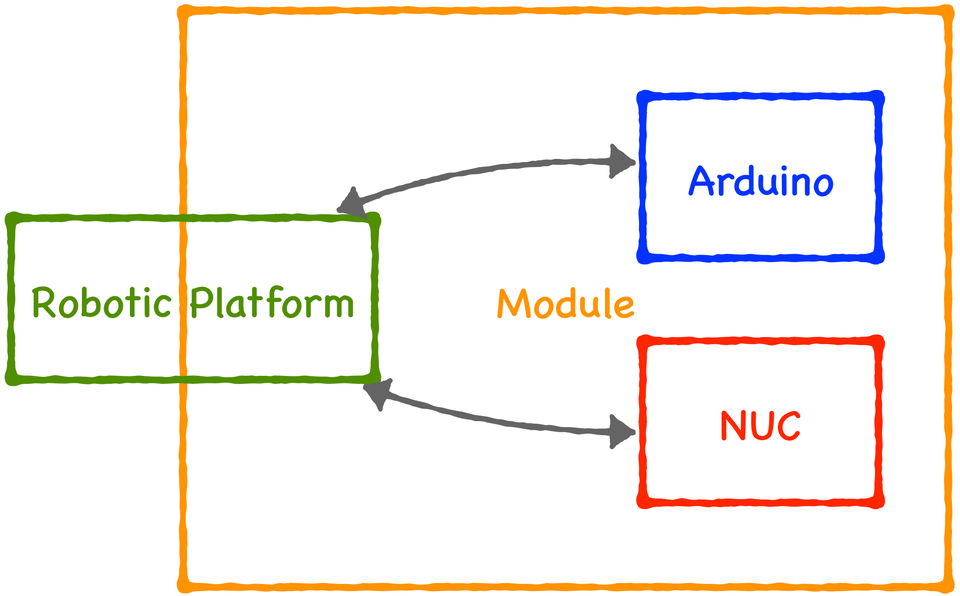
Starting the modelling process
High-level overview



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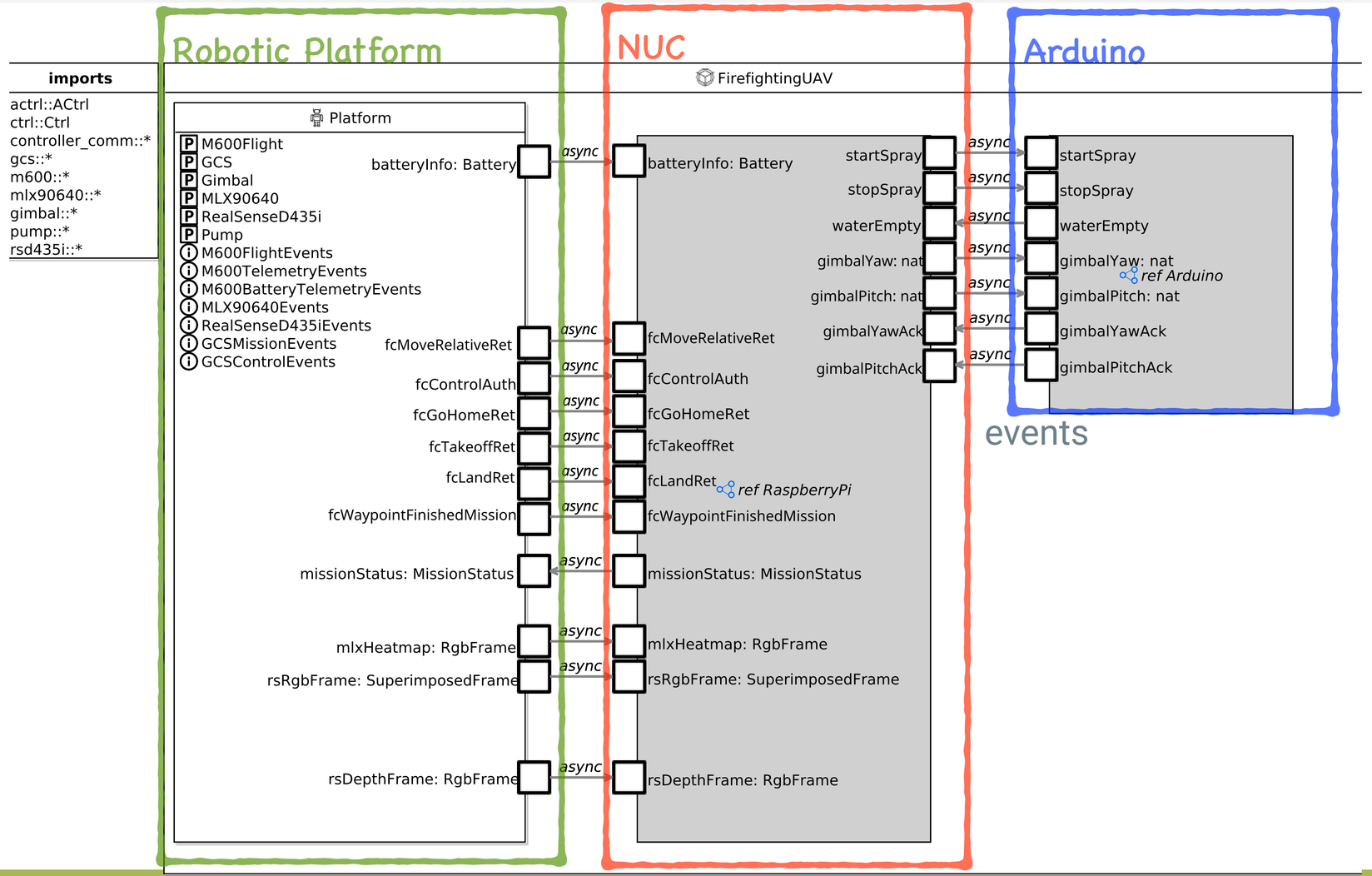
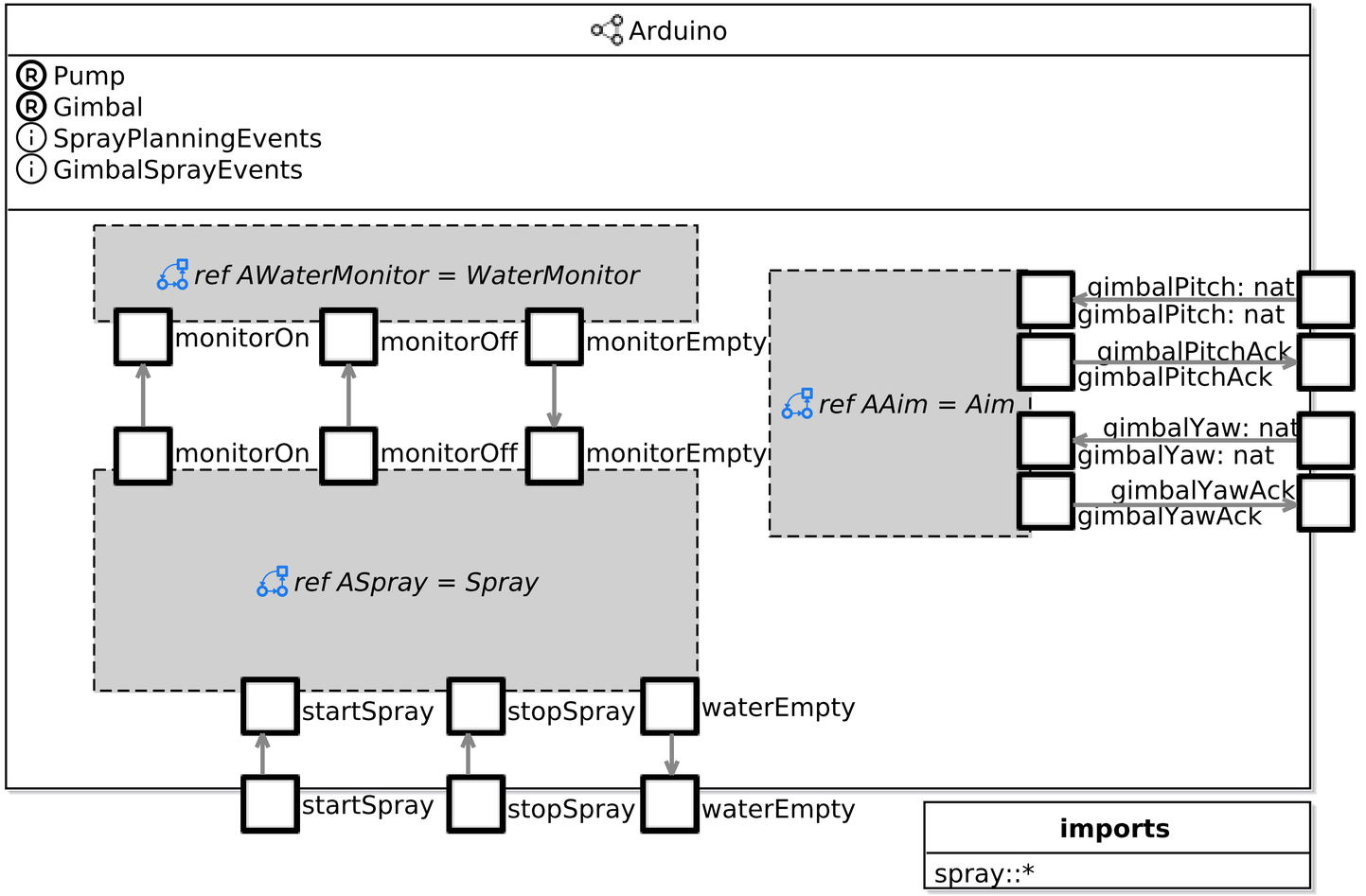
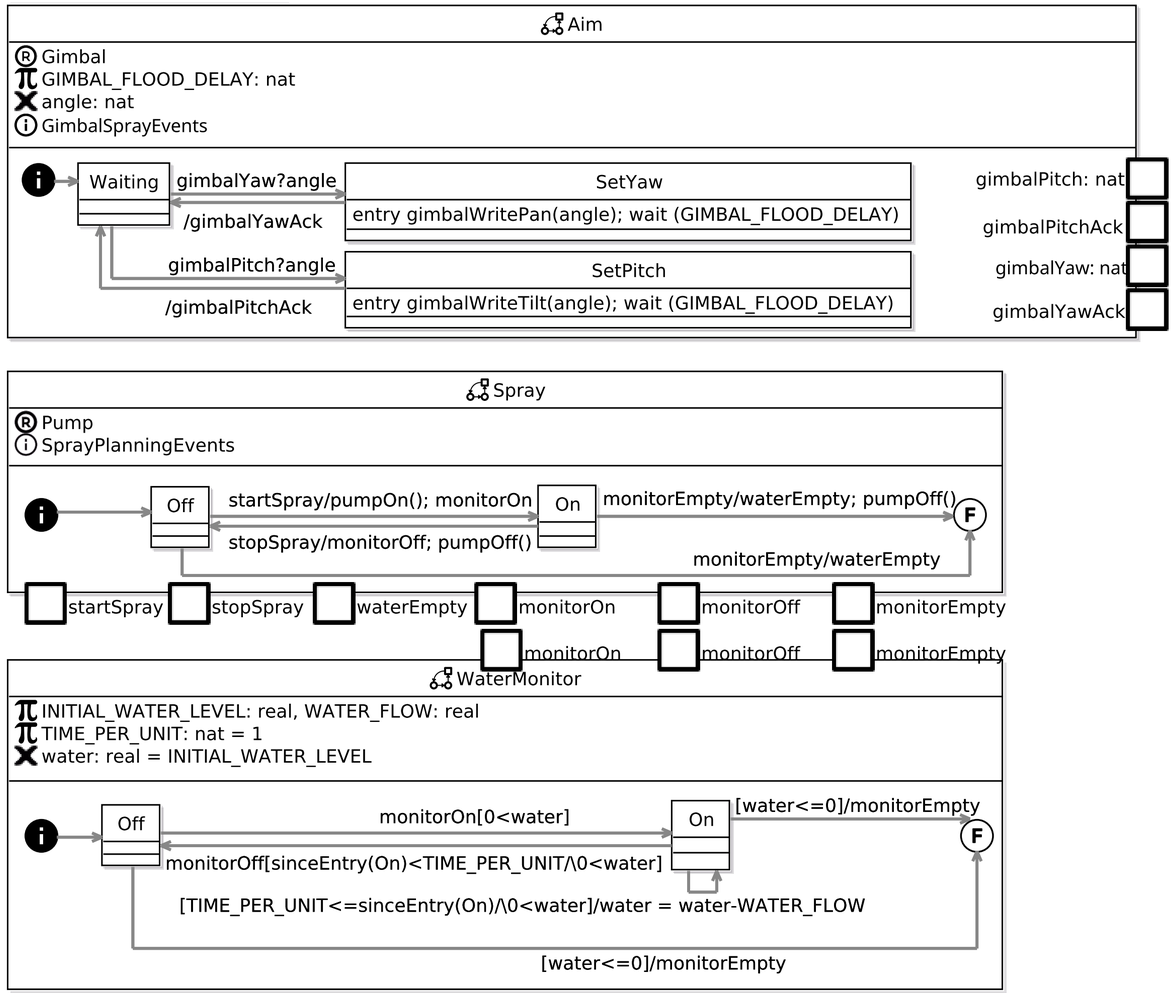
Module
RoboChart model



Controller: Arduino
RoboChart model



Arduino state machines
RoboChart model



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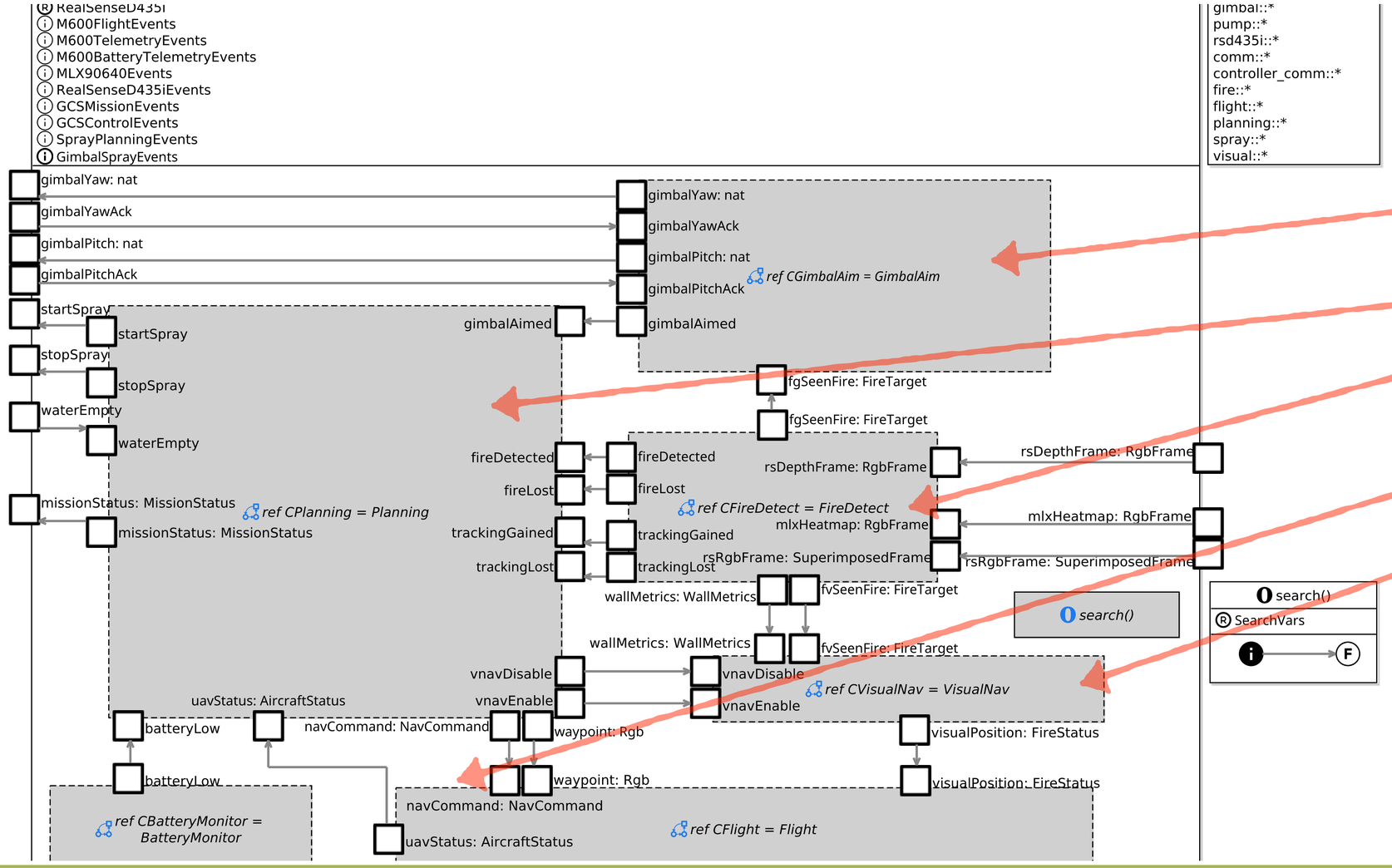
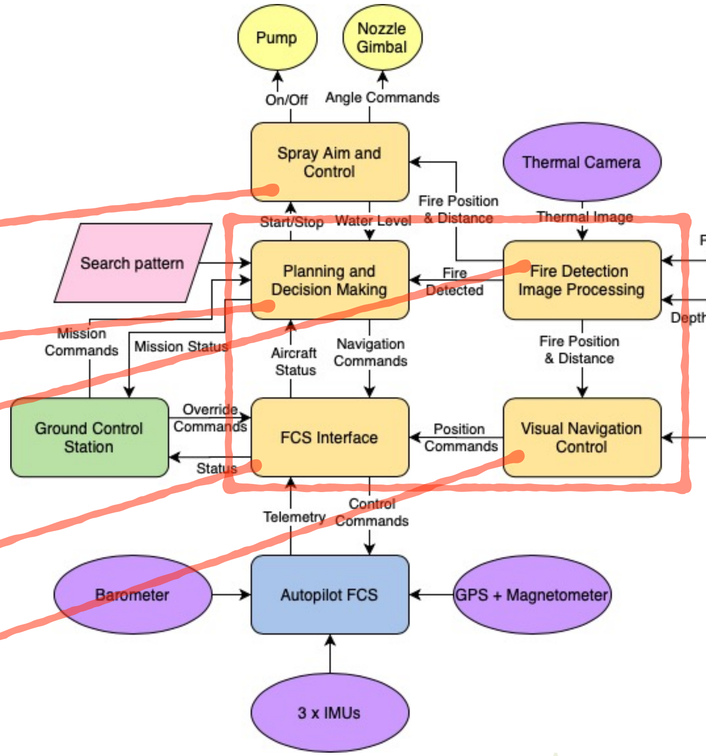
Controller: NUC
RoboChart model





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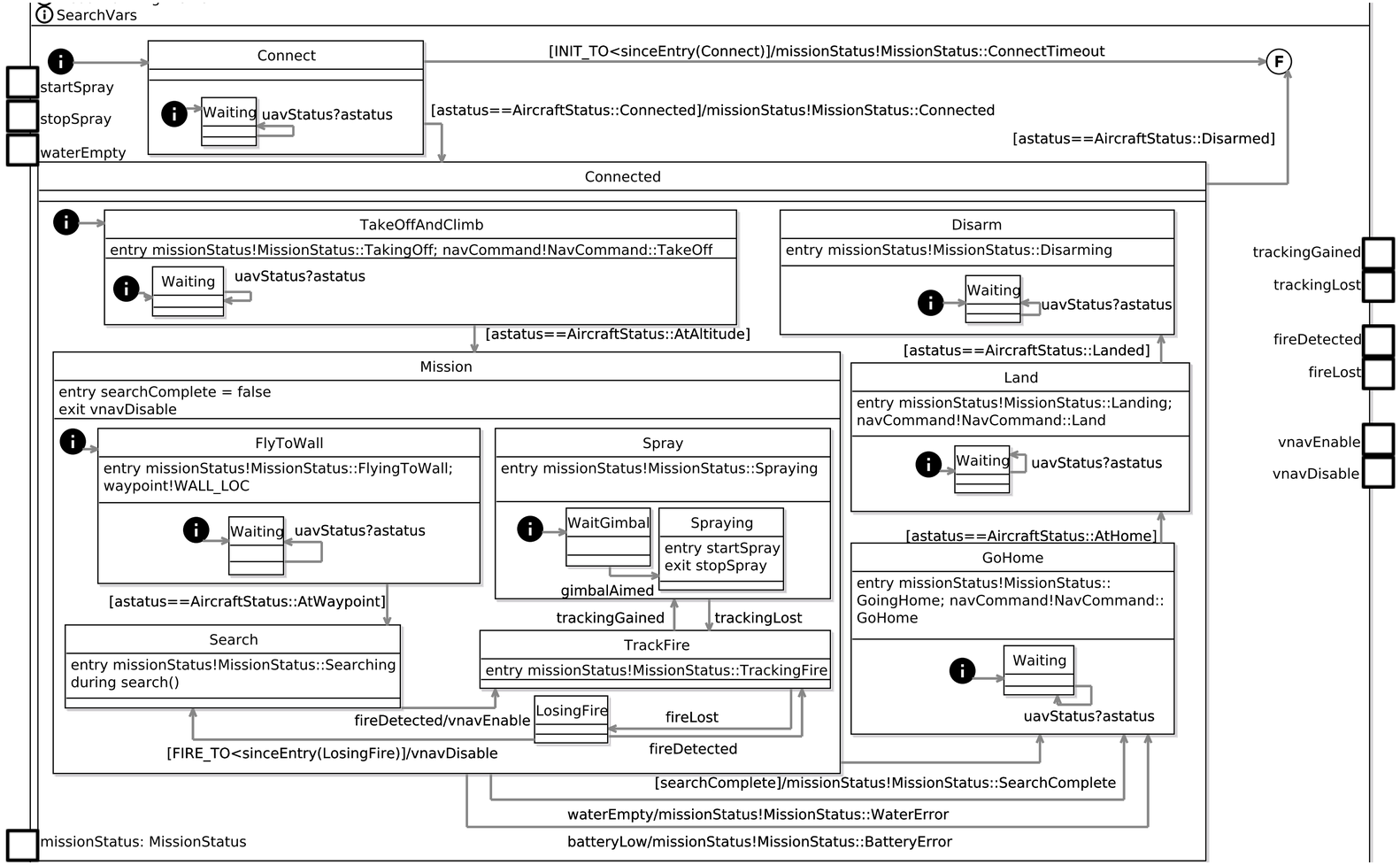
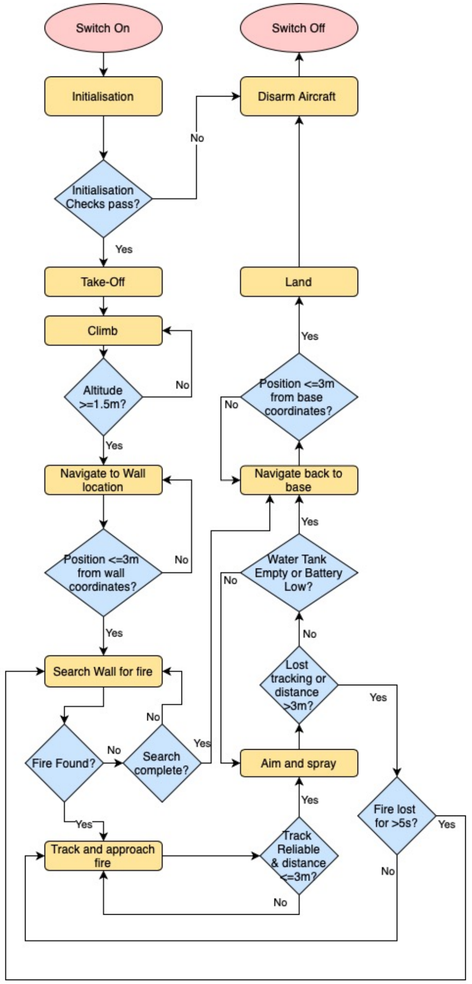
State machine: Planning
RoboChart model





use of composite states to capture interrupting behaviour

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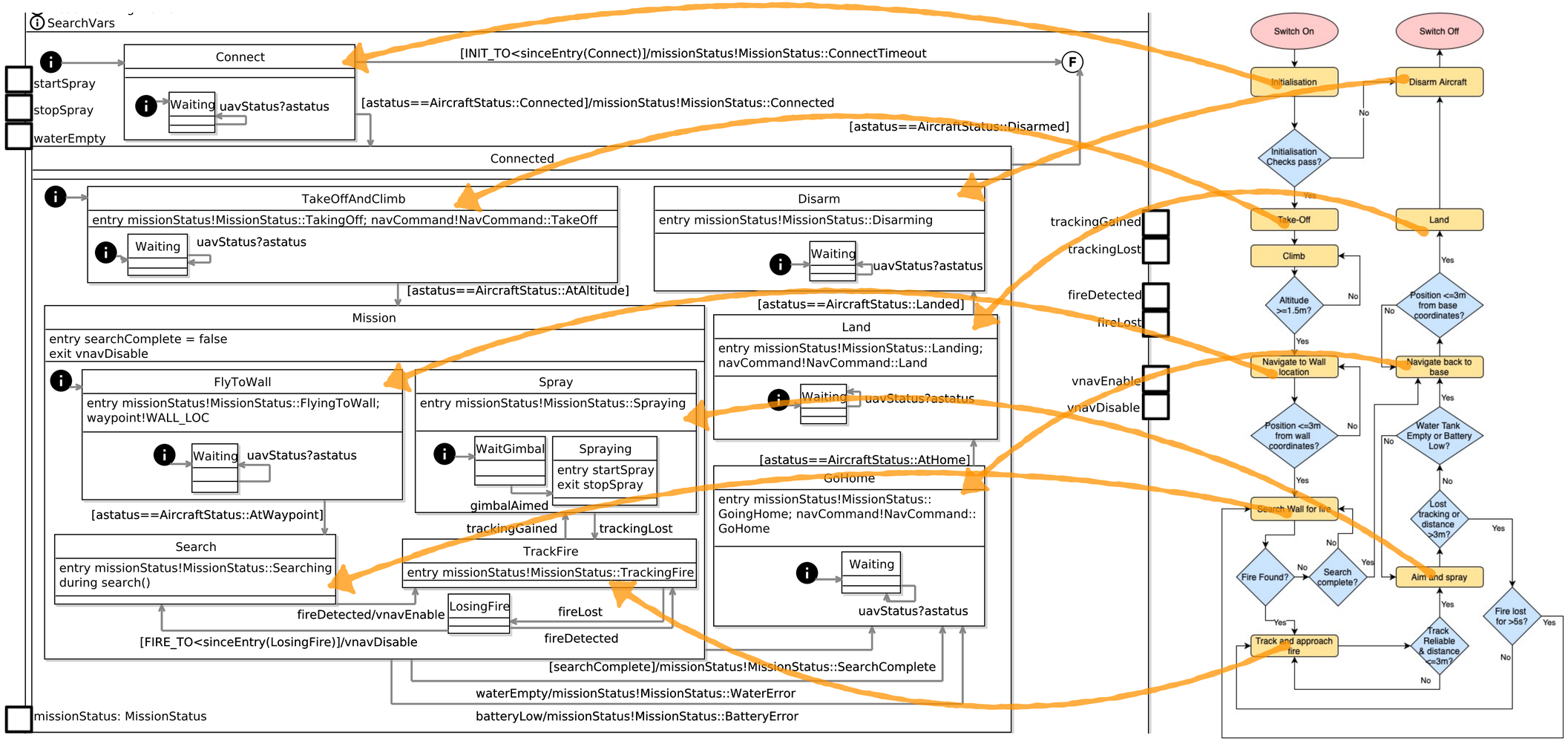
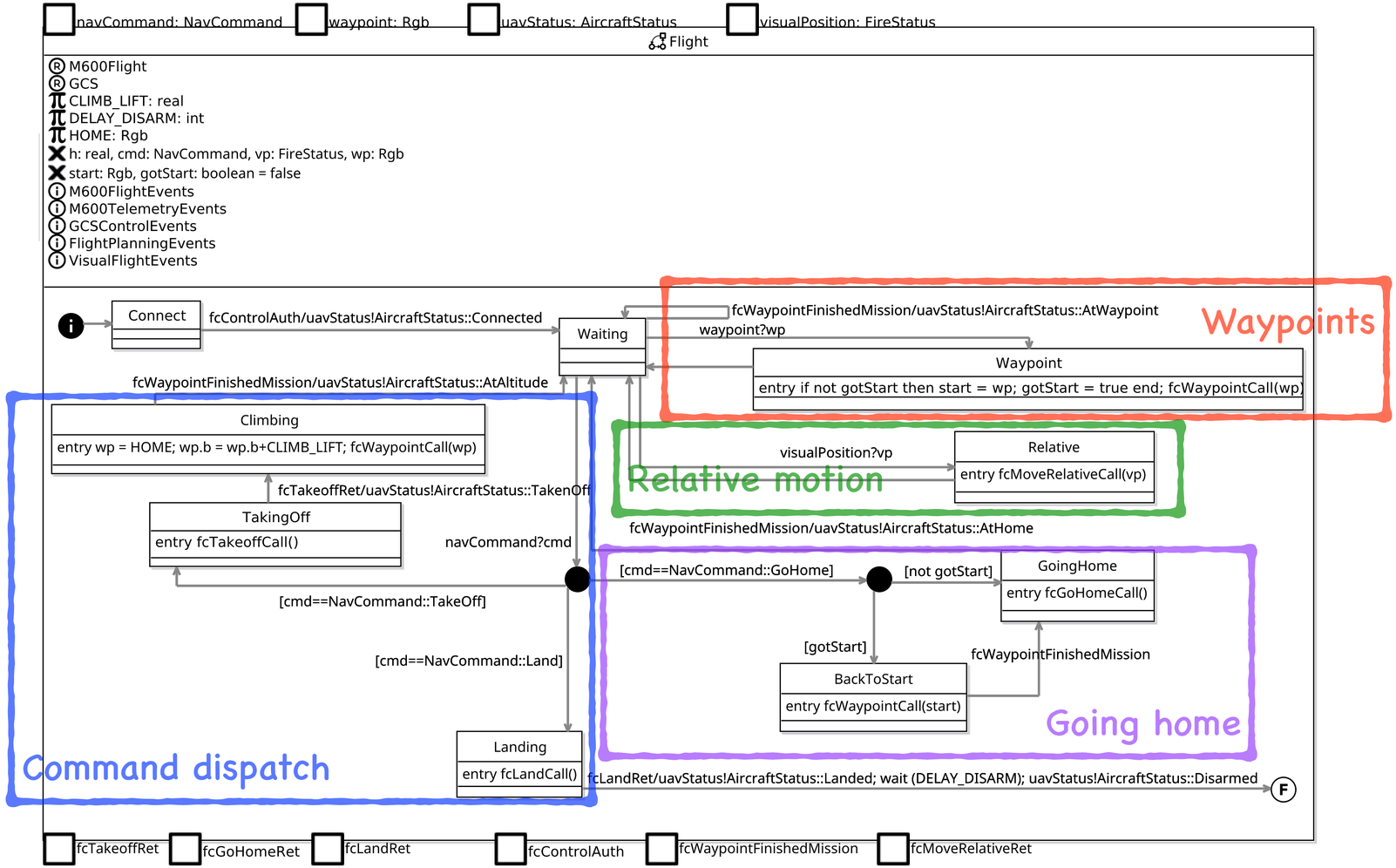
State machine: Planning
RoboChart model



use of composite states to capture interrupting behaviour

State machine: Flight control
RoboChart model



Conclusion
Not a toy example

2	controllers
9	state machines
7	hardware components interfaced

Model drafted but still work in progress

next: physical modelling >>

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