

# Agent-based Control of Autonomous Power Management

Uninhabited vehicles will be required to participate in increasingly complex missions with greater degrees of autonomy. To achieve this, it will be necessary to control power generation and consumption across the platform in an intelligent manner. This will ensure that overall mission goals are satisfied without compromising the safety and integrity of the system. In this work, an agent-based software architecture is proposed to control power allocation on autonomous uninhabited vehicles. Our architecture features a hierarchical distributed decision framework for intelligent power management. Furthermore, robust mechanisms for protection against faults are discussed. The aim of this work is to use the Intelligent Electrical Power Networks Evaluation Facility (IEPNEF) as a test-bed for evaluating the architecture.

## Aim

To provide a fully kitted-out, flexible facility with the ability to integrate multiple electrical loads and multiple power sources. Utilise this facility to exercise intelligent power management on Unmanned Vehicles using software agent technology.

## Approach

Development of a facility with novel technologies, supported by modelling and simulation, to overcome the key issues and challenges to enable system improvements. Development of agent-based simulation and control tool for demonstration of intelligent power management for UxVs.

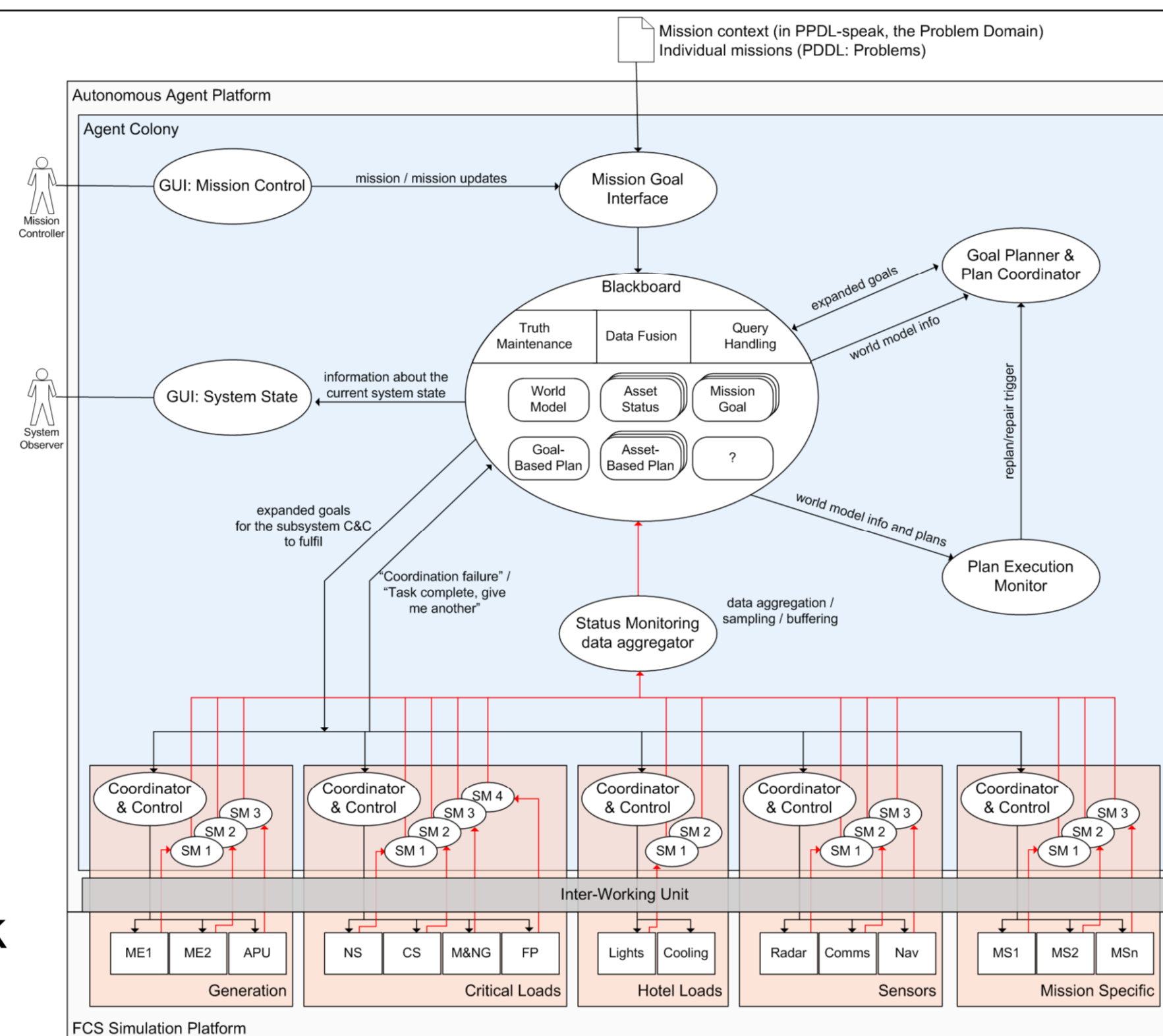
## Outcomes

A facility has been developed to integrate novel technologies for power dense systems. The control of multiple generators and loads based on given mission profile of UxVs exercising intelligent power management. Demonstration of intelligent agent technology as a robust planning method for uncertain mission scenarios.



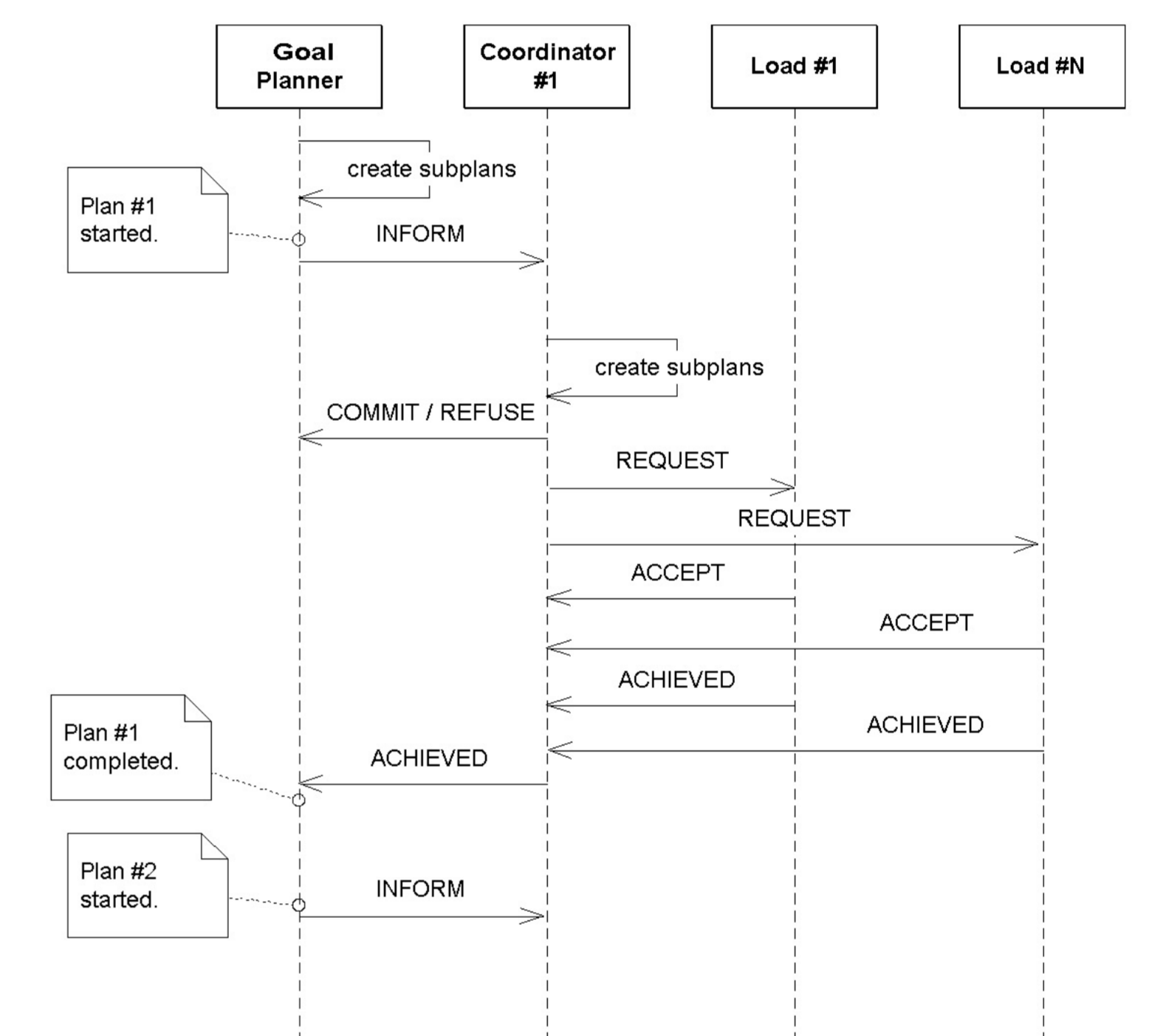
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- the +/-270V DC electrical power network has a continuous electrical power generation capability of 100kW, generated by both a 30kW switched reluctance generator and 70kW permanent magnet generator.
- loading capability comprises passive loading in the presence of two 25kW resistive load banks as well as two newly commissioned 30kW advanced systems to emulate active loads.
- the facility architecture makes the distinction between the aero-platform type electrical network (generators, ring and protection devices) and the emulating devices to replicate aircraft loads.



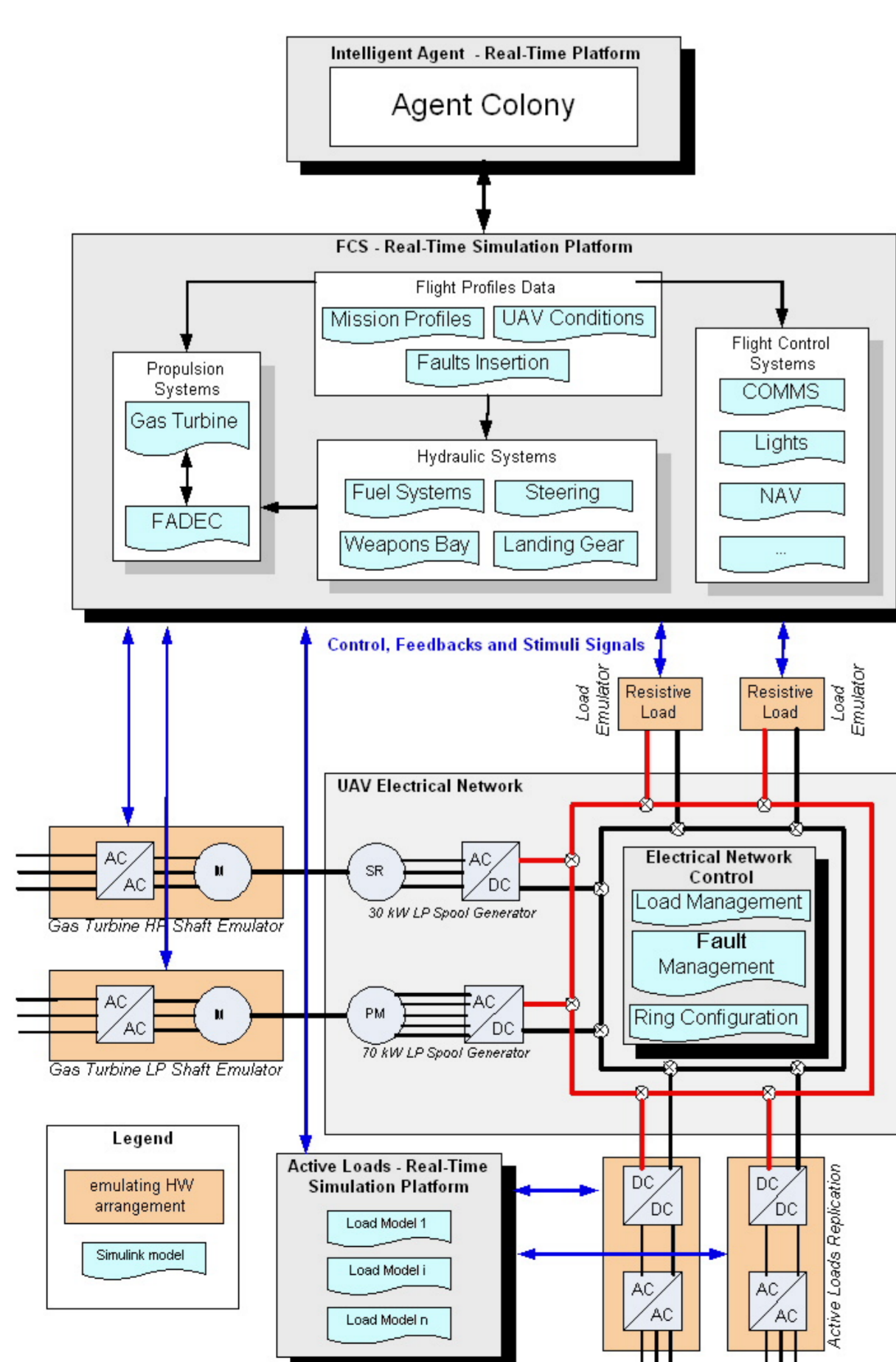
Hierarchical Agent Architecture

- agents and asset/subsystem breakdown
- intermediate agent to perform aggregation and buffering of asset status information
- the mission-specific agents (MS1, MS2 and MS3) can include radar, mission specific comms, SAR, weapons system, etc.

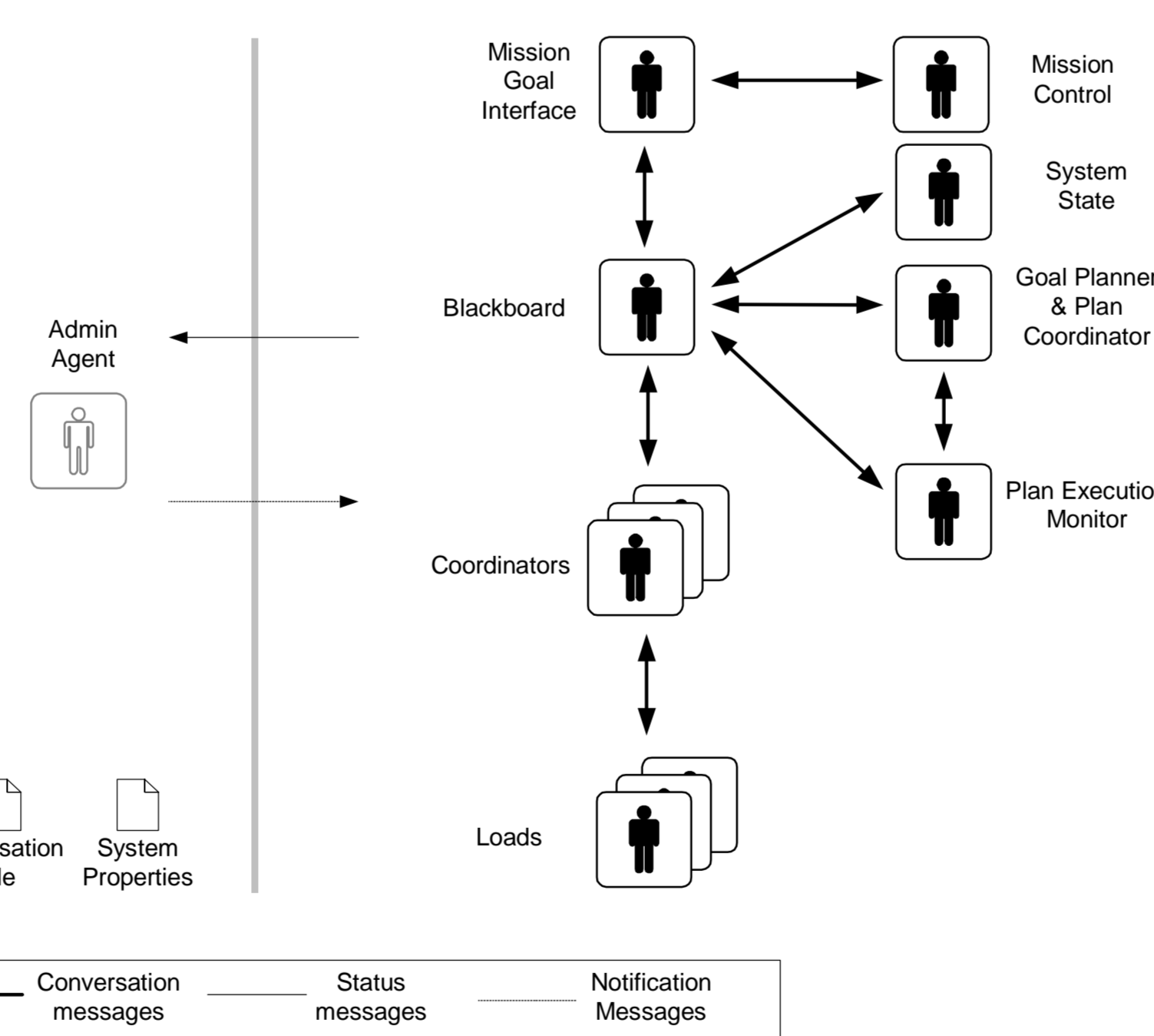


Task Delegation via Negotiation

- after receiving a sub-goal, the plan executor coordinator agent parses and resolves it into a sequence of low-level tasks
- low-level tasks are delegated to the load agents for execution.

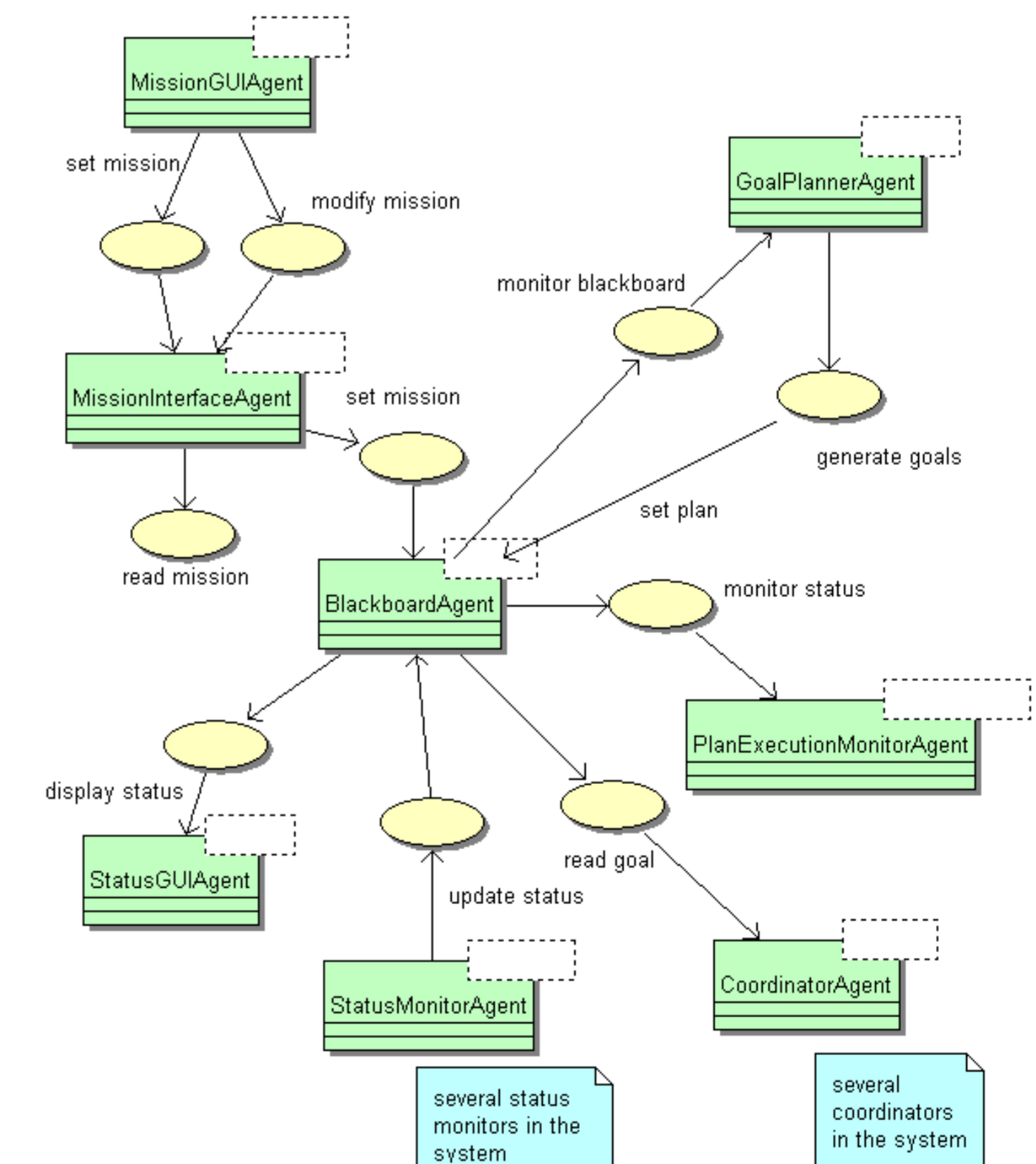


IEPNEF Simulation Architecture



Conversation Paths between Agents

- an agent runs within its own thread of execution and concurrently with other agents
- to achieve their goals and system task, they communicate with each exchanging specialised constructs based on ACL.



High-Level Use Cases

- set of high-level tasks performed by the agent colony.

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