

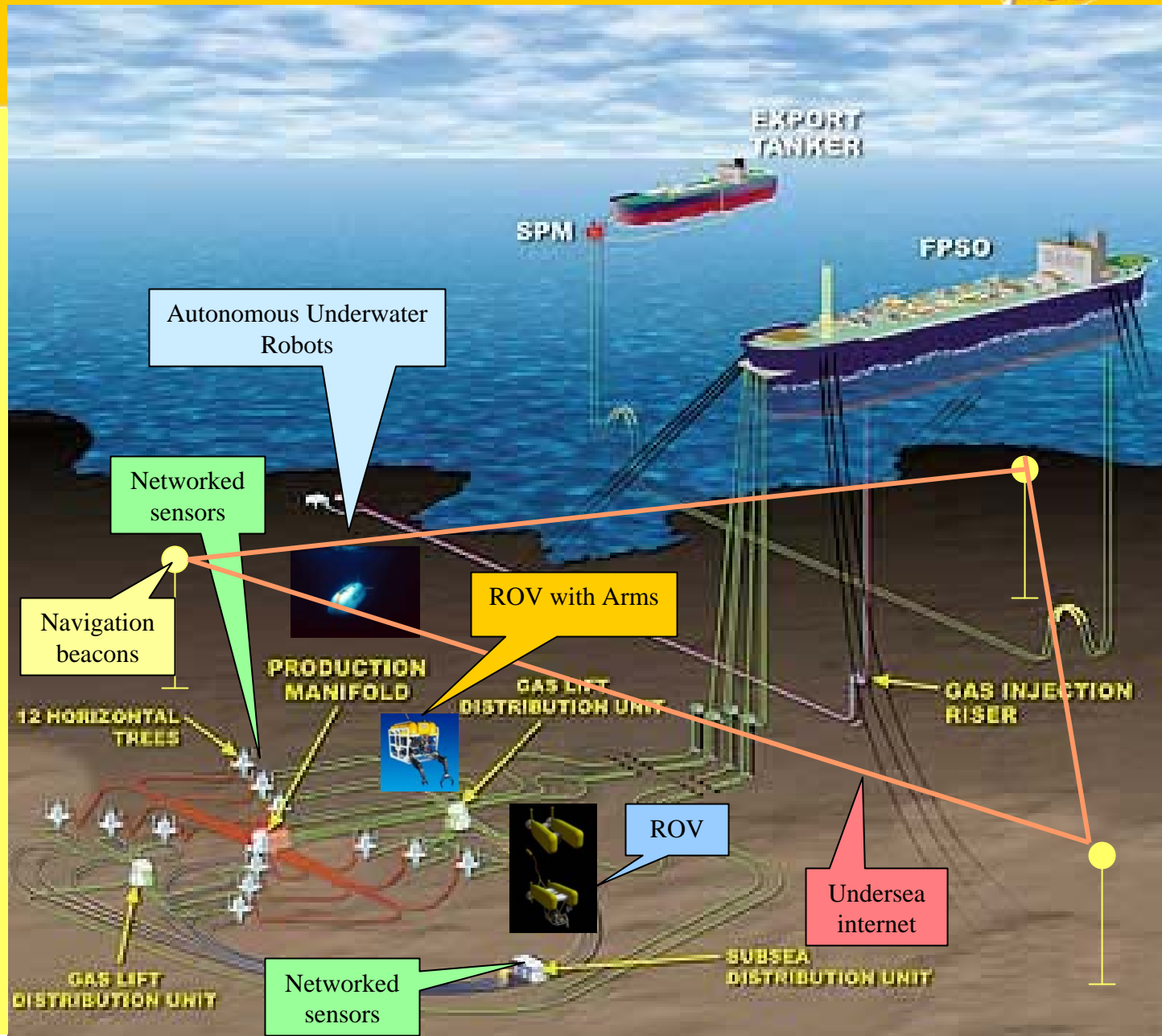
- Off-shore Technology is Highly Developed
  - More than half a century old
  - Uses best technology available world-wide
  - Money is no object
- What has changed?
  - Ultra deep water, methane hydrates, complex stratigraphy
  - Too deep for divers
- Complex operations needed
  - Multiple wells from one platform
    - some work by Remote Operations via ROVs
    - some work by Autonomous Vehicles
  - Time lag due to transmission delays

## ISI Technologies

- Assembly Automation
- Reconfigurable robotics
- Space robotics
- Communications Technology
- Sensor Nets
- Underwater robots (with Wrigley Institute)
- Grid Computing
- Custom VLSI multi-processors
- Embedded systems eg S.A. radar
- Rad-hard systems plus FPGA and DSP
- AI

## Photos

- UAV – r2D4 U of Tokyo
- ROV with arms --Seaeye
- ROV -- WHOI



- Deep sea completion involves multiple movements of the drill string to add BOP, manifolds, trees, valving, pipe measuring instruments etc
- Manipulation can involve high forces, but needs a sensitive touch to avoid issues such as cross-threading
- As in Space Operations there are reaction forces on free flyers that move them out of position, registration
- Multiple arms choreographed **to the task** not to location i.e. referenced to the job
- Big Issues for Autonomy
  - Grippers---how complex?, grasping strategies?
  - Degrees of freedom?
  - Tooling?
  - Sensor modalities?
  - Commands, command languages?