



2019 CONFERENCE: MARITIME AUTONOMOUS SYSTEMS REGULATORY CONFERENCE

INTELLIGENT ADAPTIVE SYSTEMS
AND ARTIFICIAL INTELLIGENCE
FOR ADDRESSING HUMAN AUTONOMY
TEAMING CHALLENGES

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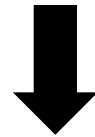


INTELLIGENT ADAPTIVE SYSTEMS

INTELLIGENT ADAPTIVE SYSTEMS



**Why do we need intelligent systems
for mission critical applications ?**



- **To manage complexity**
- **To manage risk**

TYPES OF COMPLEXITY IN MISSION-CRITICAL APPLICATIONS



Operator State Monitoring
Working Environment
Dynamic Space
Mission Context

ENVIRONMENTAL

ORGANIZATIONAL

Procedures
Crew Interactions
Tasking & Reporting
Authorizations

Multiple displays
Visual Overload
Excessive inputs
Trust Management

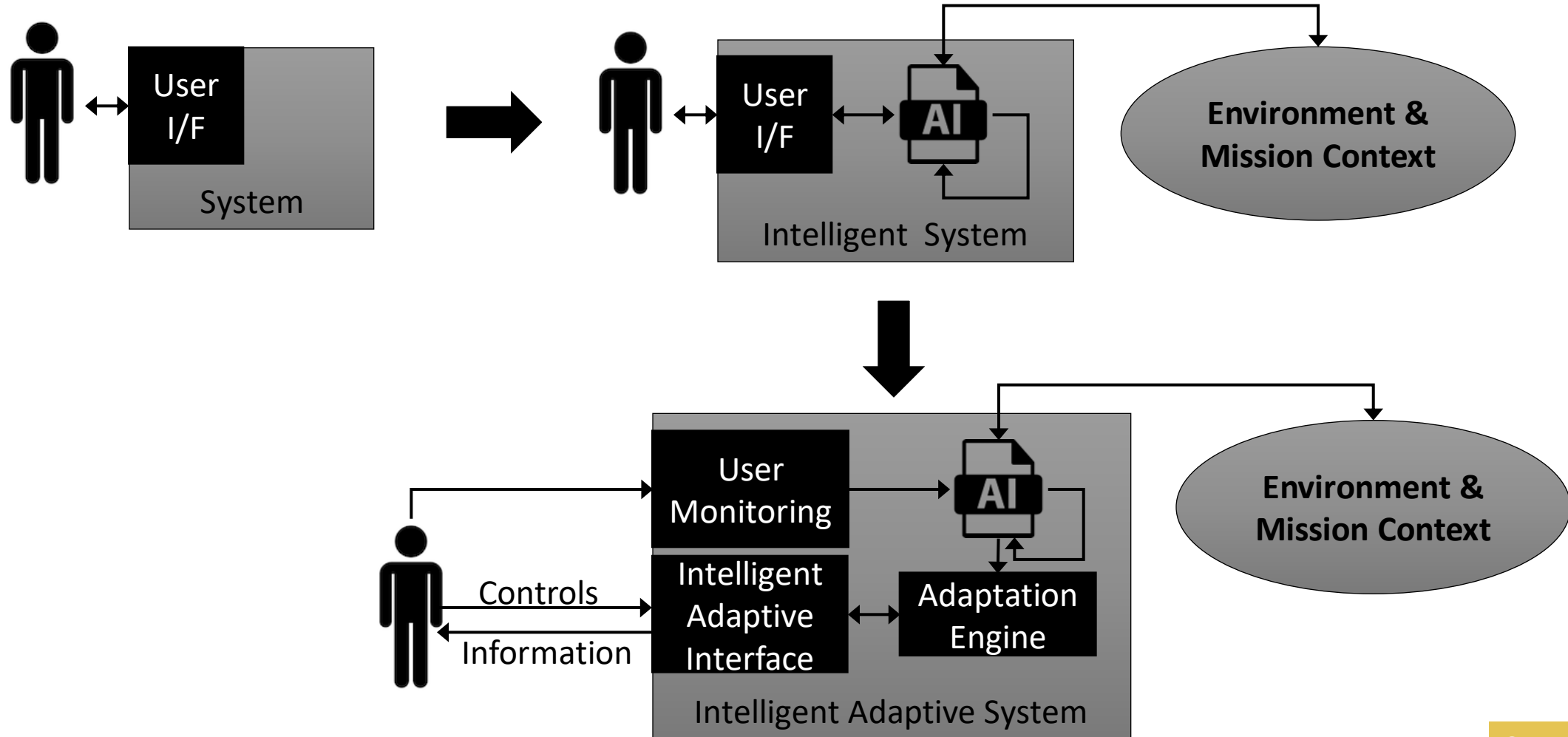
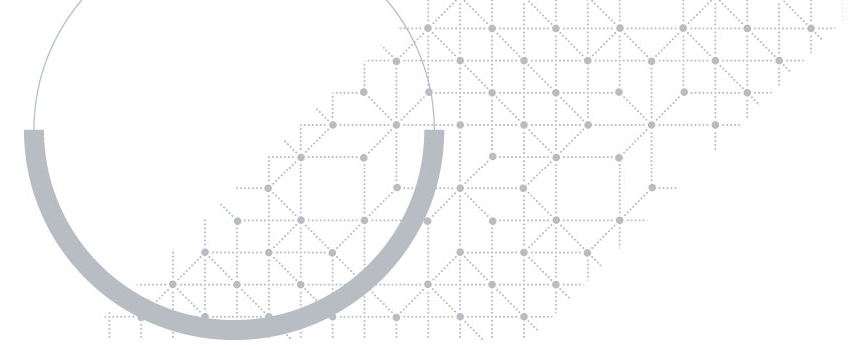
INTERFACE

COGNITIVE

Information Overload
Prioritizing decision-making
Maintaining situational awareness



INTELLIGENT ADAPTIVE SYSTEMS

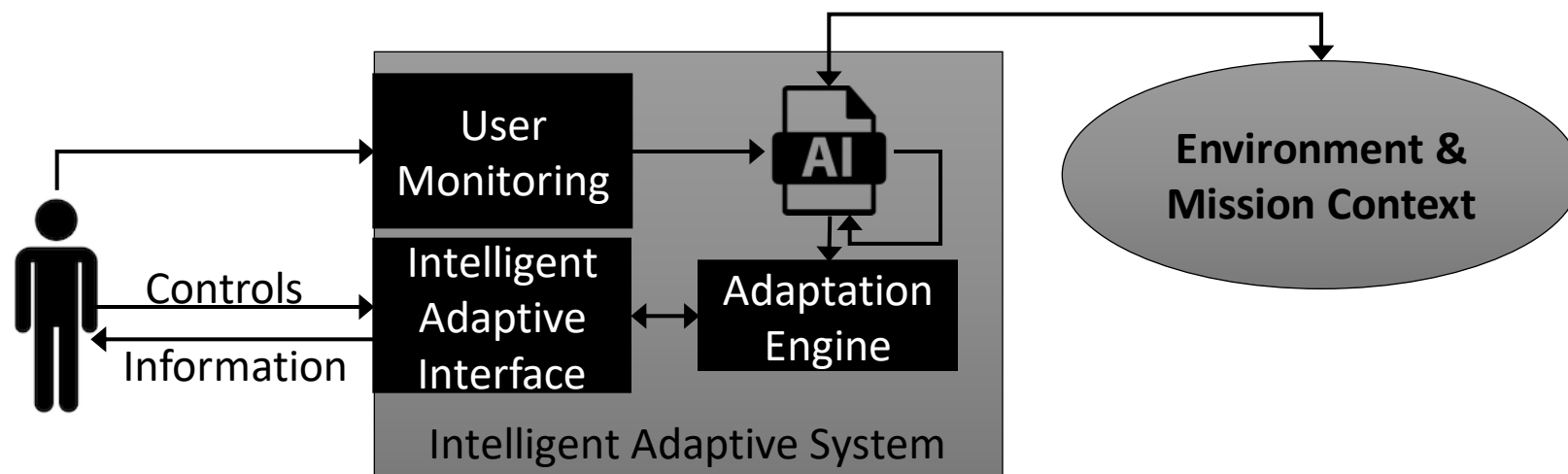


INTELLIGENT ADAPTIVE SYSTEMS



An Intelligent Adaptive System (IAS) is:

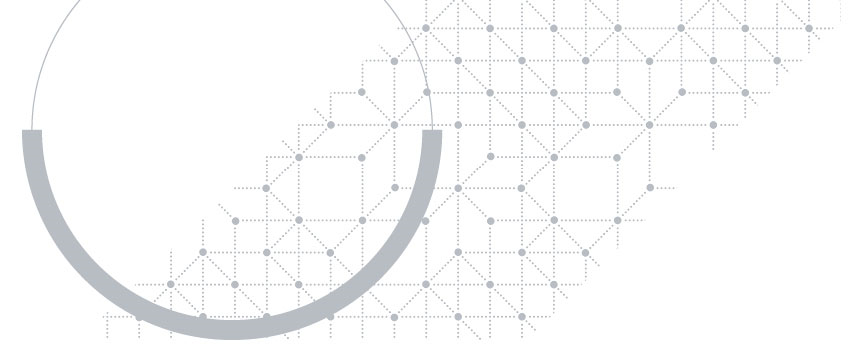
- a system that uses automation technologies to adjust its behavior and adapt dynamically to changing tasks, operator states, the work environment and the mission context.
- focused on dynamic adaptation (e.g., who, what, where, when, why and how) to optimize human-machine interactions for safe, effective, and efficient operations.



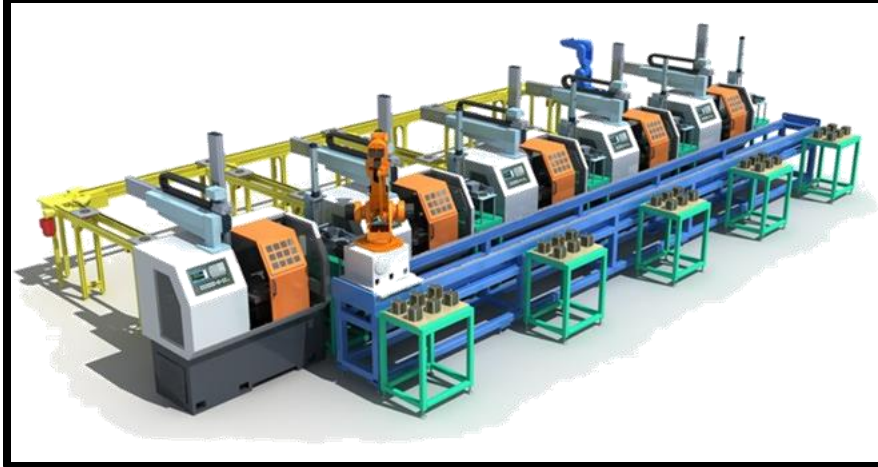


INTELLIGENT ADAPTIVE SYSTEMS & HUMAN AUTONOMY TEAMING

AUTOMATION & AUTONOMY

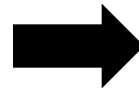


*Automation : Machines replace humans



**Autonomy = decision-making

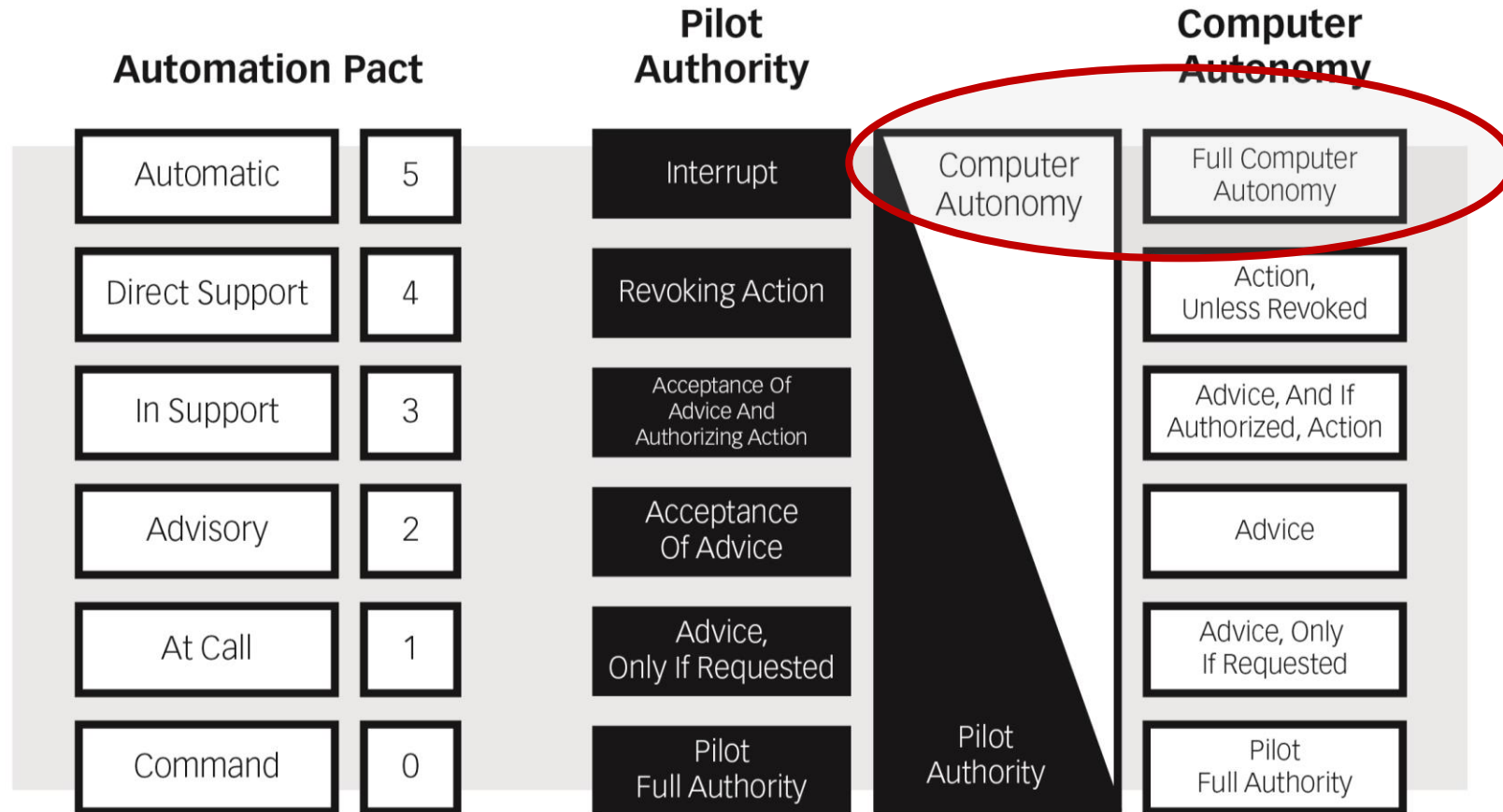
Automation \neq Autonomy
(removes human)



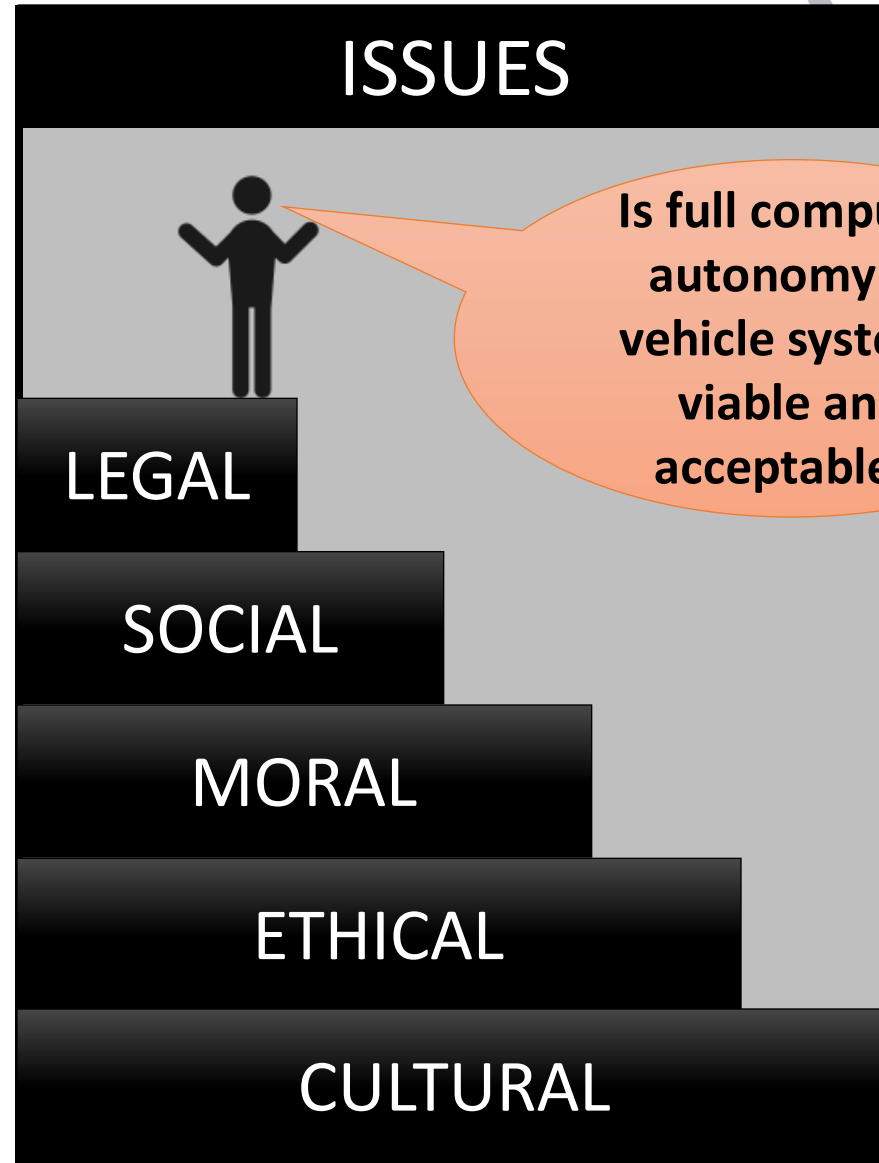
Autonomy requires automation
(generally with humans)

- *Automation is the use of machines and technology to make processes run on their own without manpower.
- **Autonomy is the quality or state of being self-governing, self-directing, the ability to make your own decisions.

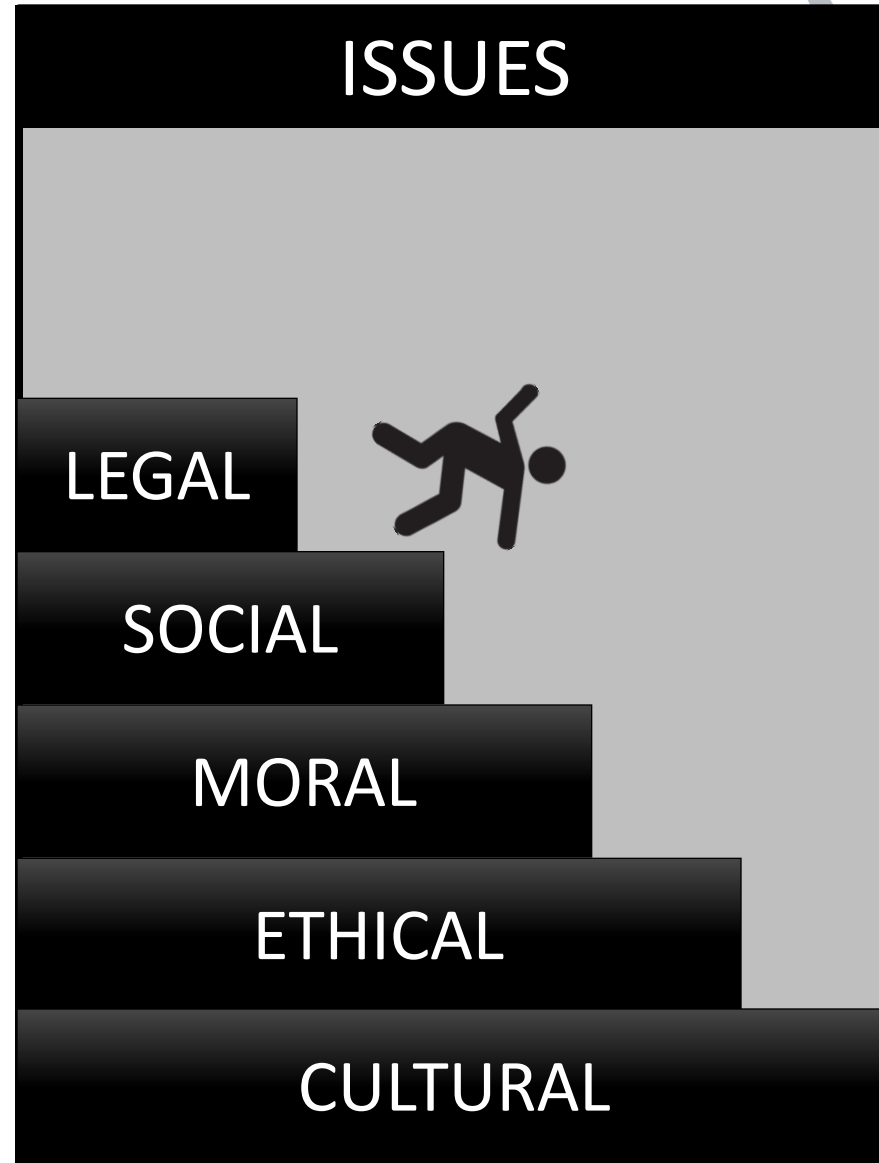
AUTOMATION & AUTONOMY



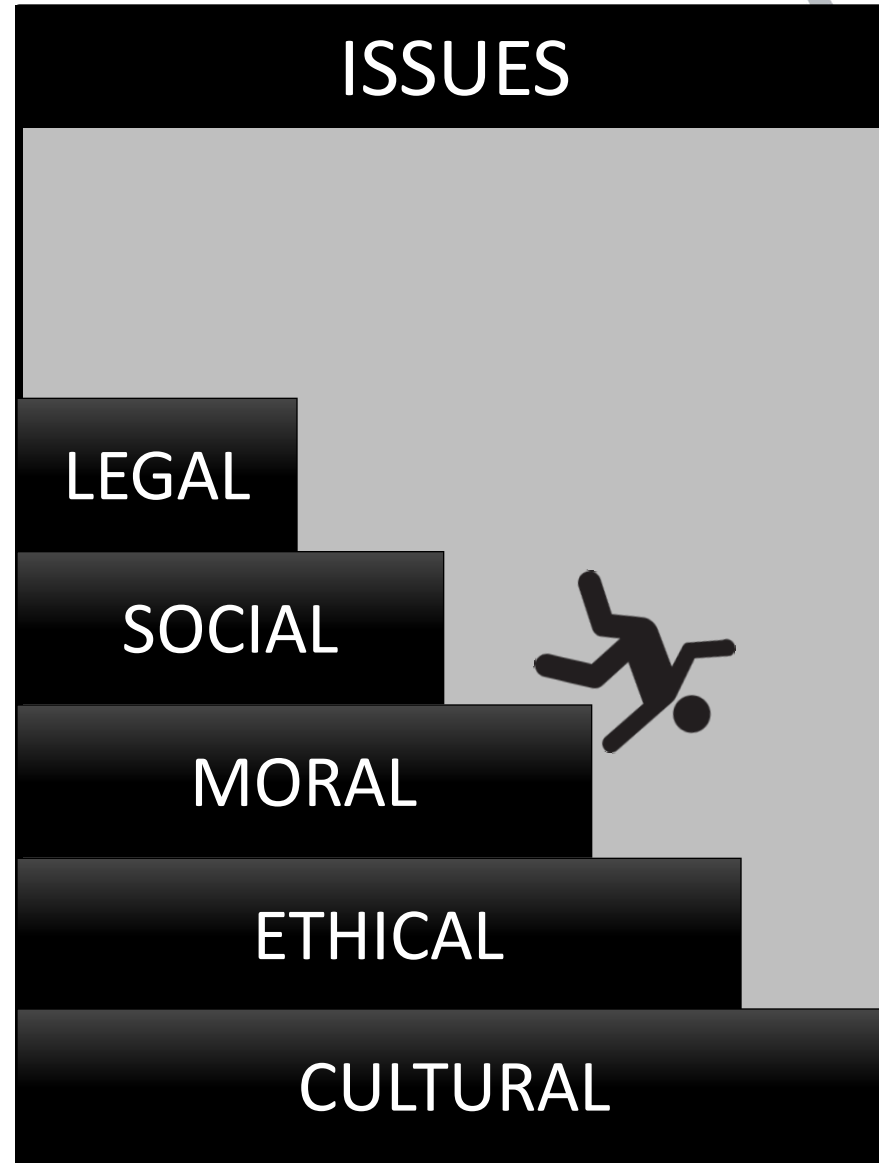
WHY HUMAN-AUTONOMY TEAMING ?



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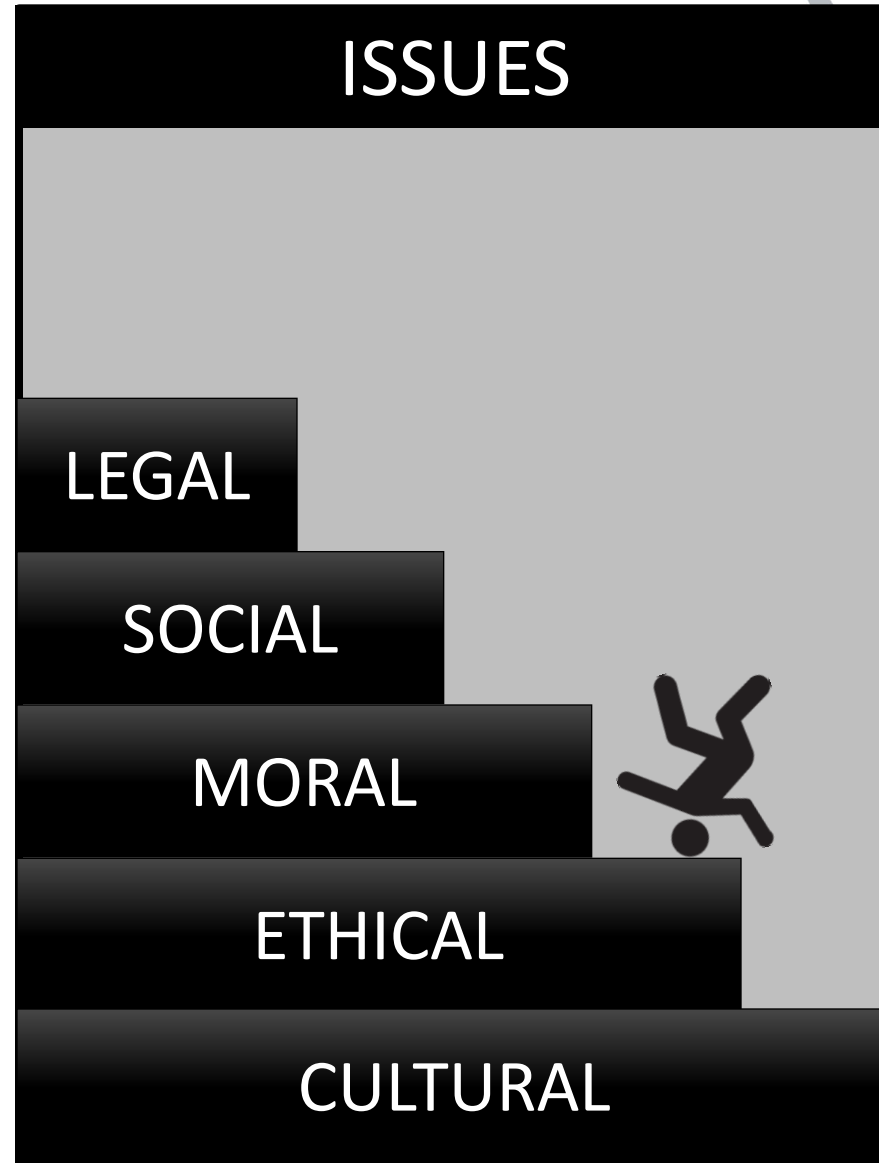


WHY HUMAN-AUTONOMY TEAMING ?



- To manage complexity
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WHY HUMAN-AUTONOMY TEAMING ?



- To manage complexity
- To manage risk

WHY HUMAN-AUTONOMY TEAMING ?



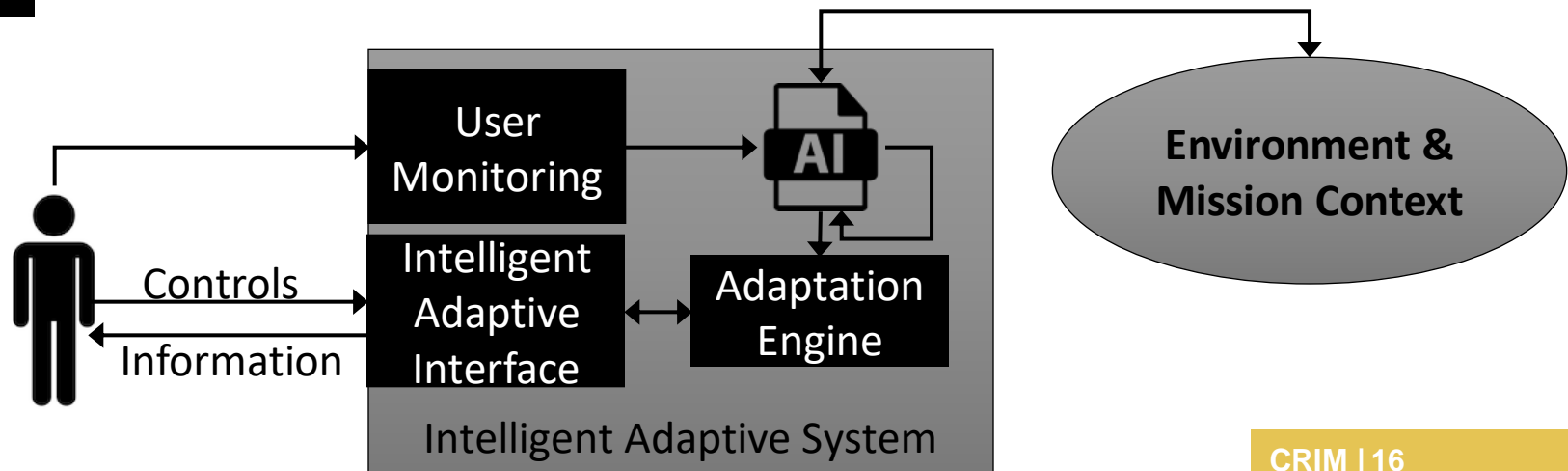
- To manage complexity
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HUMAN AUTONOMY TEAMING



- Transparent Automation
- Bi-directional Communication
- Operator-directed Authority

Human-Autonomy Teaming





HUMAN-AUTONOMY TEAMING CHALLENGES IN AUTONOMOUS VEHICLE SYSTEMS

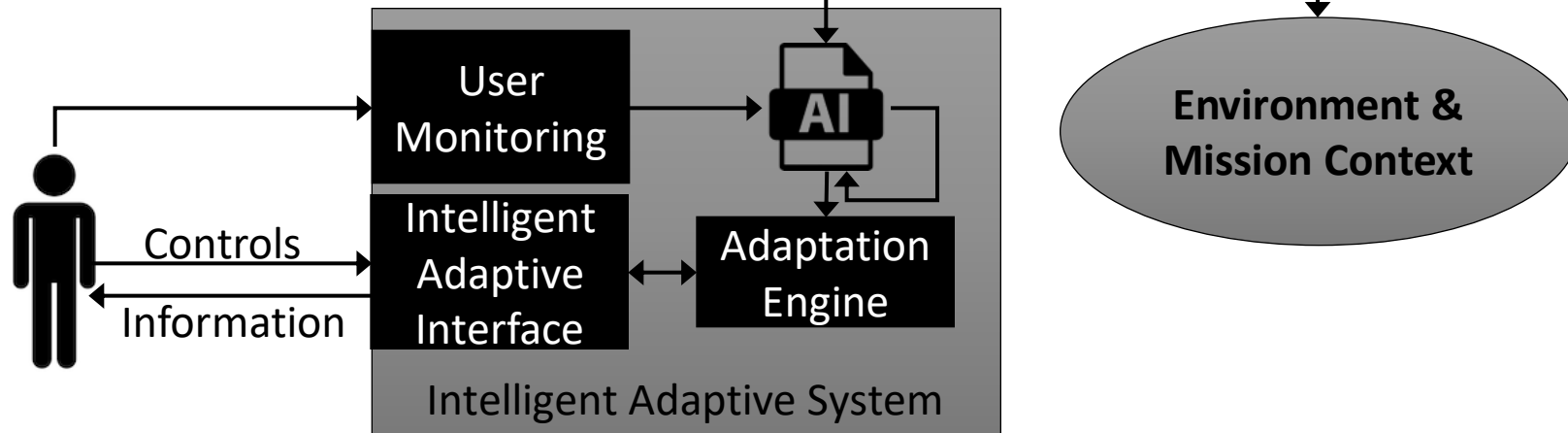
HUMAN AUTONOMY TEAMING CHALLENGES

1. Non-intrusive Operator State Monitoring

- a. Multi-modal (speech, facial/eyes analysis)
- b. Fatigue, Stress, Cognitive Overload
- c. Trust

2. Decision-making

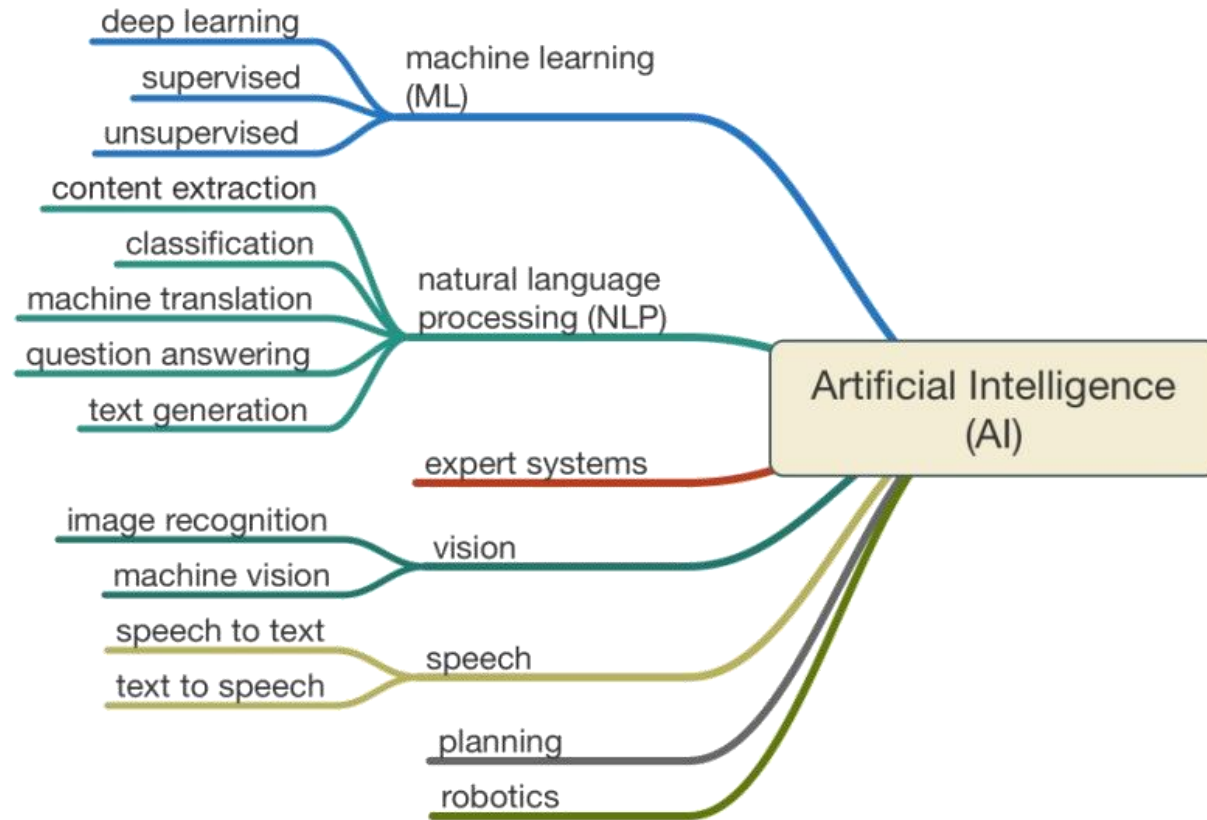
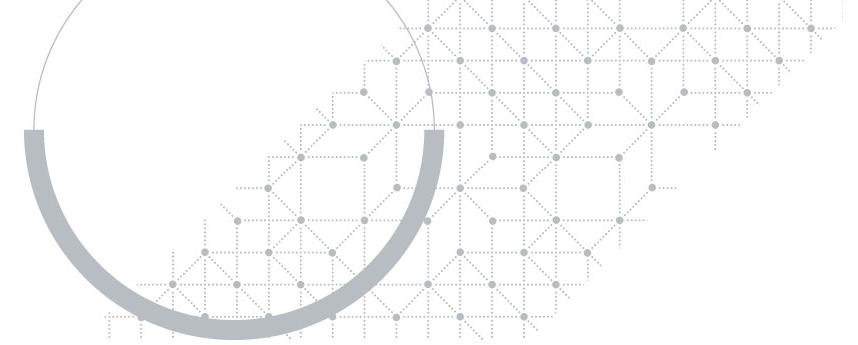
- a. Must be performed rapidly
- b. Judgement under unexpected or unanticipated conditions
- c. Trust





USING AI TO ADDRESS HUMAN-AUTONOMY TEAMING CHALLENGES

ARTIFICIAL INTELLIGENCE TECHNOLOGIES TO IAS



10 HOTTEST AI Technologies*

1. Natural Language Generation
2. Speech Recognition
3. Machine Learning
4. Virtual Agents
5. Decision Management
6. AI-Optimized Hardware
7. Deep Learning
8. Robotic Process Automation
9. Text Analytics and NLP
10. Biometrics



QUESTIONS ?