Summary:

The Real-time Control System (RCS) architecture developed at NIST and elsewhere over the past two decades (Barbera, Albus, &: Fitzgerald 1979; Albus et al. 1982; Albus 1991; ) defines a canonical form for a nested intelligent control system. The RCS architecture consists of a hierarchically layered set of processing modules connected together by a network of communications pathways. The primary distinguishing feature of the layers is the bandwidth of the control loops.

At each level, tasks are decomposed into sequential subtasks, to be performed by cooperating sets of subordinate agents. Signals from sensors are filtered and correlated with spatial and temporal features that are relevant to the control function being implemented at that level.

The four basic types of processing modules from which the RCS architecture is built are:

1. Behavior Generating (BG) modules. BG modules contain job assignment, planning, and control algorithms. These embody knowledge about how to perform tasks - i.e. how to decompose tasks into subtasks that subordinate agents know how to execute.
2. World Modeling (WM) modules The WM modules model the state space of the problem domain. They contain information storage and retrieval mechanisms, as well as algorithms for transforming information from one coordinate system to another.
3. Sensory Processing (SP) modules SP modules process data from visual, auditory, tactile, proprioceptive, taste, or smell sensors. SP modules contain filtering, masking, differencing, correlation, matching, and recursive estimation algorithms, as well as feature detection and pattern recognition algorithm.

1. Value Judgment (V J) modules VJ modules contain algorithms for computing cost, risk, and benefit, for evaluating states and situations, for estimating the reliability of state estimations, and for assigning cost-benefit values to objects and event.
2. Knowledge Database (KD) modules KD modules consist of data structures that contain state variables, iconic images, and symbolic frames containing lists of attributes. Information in the KD includes knowledge about entities and events, and about how the world behaves, both logically and dynamically.
3. A communication system that conveys messages between the various modules. The communication system provides a network of pathways that transmits messages between the various processing and database modules.

The RCS architecture has been used in the implementation of a number of experimental projects. These include:

1. A Horizontal Machining Workstation
2. A Cleaning and Deburring Workstation
3. An Advanced Deburring and Chamfering System
4. NBS/NASA Standard Reference Model Architecture for the Space Station Telerobotic Servicer (NASREM)
5. An architecture for Coal Mining Automation
6. An nuclear submarine maneuvering system
7. A control system for a U.S. Postal Service Automated Stamp Distribution Center
8. A control system for Multiple Autonomous Undersea Vehicles
9. An RCS system for remote driving This system was implemented an Army HMMW
10. An Open Architecture Enhanced Machine Controller.