

Model-based Knowledge Management for Distributed Workteams

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SemanticOrganizer is a model-based knowledge management system that provides customizable information storage and access capabilities for distributed NASA workteams. The system consists of an information repository that structures work products according to distinctions and semantic relationships that are relevant to a given workteam. The system models information using an ontology of workteam-specific concepts, properties, and relationships (links between concepts). Instantiated concepts form a network structure where each node represents a concrete or conceptual item relevant to the workteam (e.g., a specific person, place, device, subsystem, measurement, meeting, event, etc.). Each node stores a set of item properties plus an (optional) electronic file containing a document, dataset, image, or other relevant work product. Links between nodes in the network express different types of semantic relationships between items. SemanticOrganizer nodes are thus extensively cross-linked to permit easy, intuitive access to interrelated pieces of information. A web-based interface permits users to create concept instances, enter properties, and link instances together. Users navigate through the information space by traversing links from instance to instance.

InvestigationOrganizer is an application of SemanticOrganizer designed to support the teamwork of NASA accident investigators. InvestigationOrganizer has been deployed to support several recent high-profile NASA investigations, including the Shuttle Columbia accident, the CONTOUR spacecraft investigation, and the Helios unmanned aerial vehicle crash. An accident investigation ontology has been developed to capture the unique types of concepts, information products, and structures familiar to investigators and enable storage of relevant information. The ontology covers people in different roles (e.g., operator, supervisor, inspector), engineered systems (e.g. aircraft, spacecraft, wind tunnels, buildings), various types of evidence (e.g. telemetry data, design documents, engineering analyses, witness transcripts), anomalies, accident hypotheses, causal models (e.g., fault trees and event sequence models) and other items. InvestigationOrganizer also incorporates visualization tools to help view and navigate causal and system models.

The InvestigationOrganizer application shares some common goals with the VIB program; both are interested in modeling engineered systems, associating various types of information with the modeled components, and visualizing the information space. InvestigationOrganizer does not include a simulation component, although it does incorporate rule-based inferencing over the information space. Various methods of knowledge capture are supported, including methods for extracting knowledge from text documents and email stored within the repository.