

Nuclear Energy

1 HMI Enhancement and Prevention of Cyberattacks on Nuclear Power Plants

Recognizing the emergence of new threats to digital systems and cyberattacks against them, Hitachi's Services & Platforms Business Unit has established a facility for conducting security training and verification for nuclear power plants with the objectives of improving the defensibility of their control systems, strengthening the organizational structures and practices used for system operation, and developing human resources. By drawing on the business unit's expertise in designing control systems for critical infrastructure and utilizing its advanced information and telecommunications technologies, the facility will provide an environment that is very similar to that of an actual plant.

In response to recent expectations for human factors engineering (HFE) applied in the design process for the human machine interfaces (HMIs) in nuclear power plants, Hitachi-GE Nuclear Energy, Ltd. has developed full-size mock-ups and conducted HFE assessments as part of its main control room panel design activities.

The company is also seeking to make comprehensive plant safety improvements and produce better HMI designs by establishing design processes in which testing is able to be performed in ways that combine human operation with mechanical, control, and plant dynamics. This is being done using a plant simulator for design evaluation that is currently under development.

(Hitachi-GE Nuclear Energy, Ltd.)



1 Facility for conducting comprehensive security training and verification against cyberattacks, and the use of a central control room mock-up for design evaluation

2 Operation and Maintenance for Nuclear Power Plants

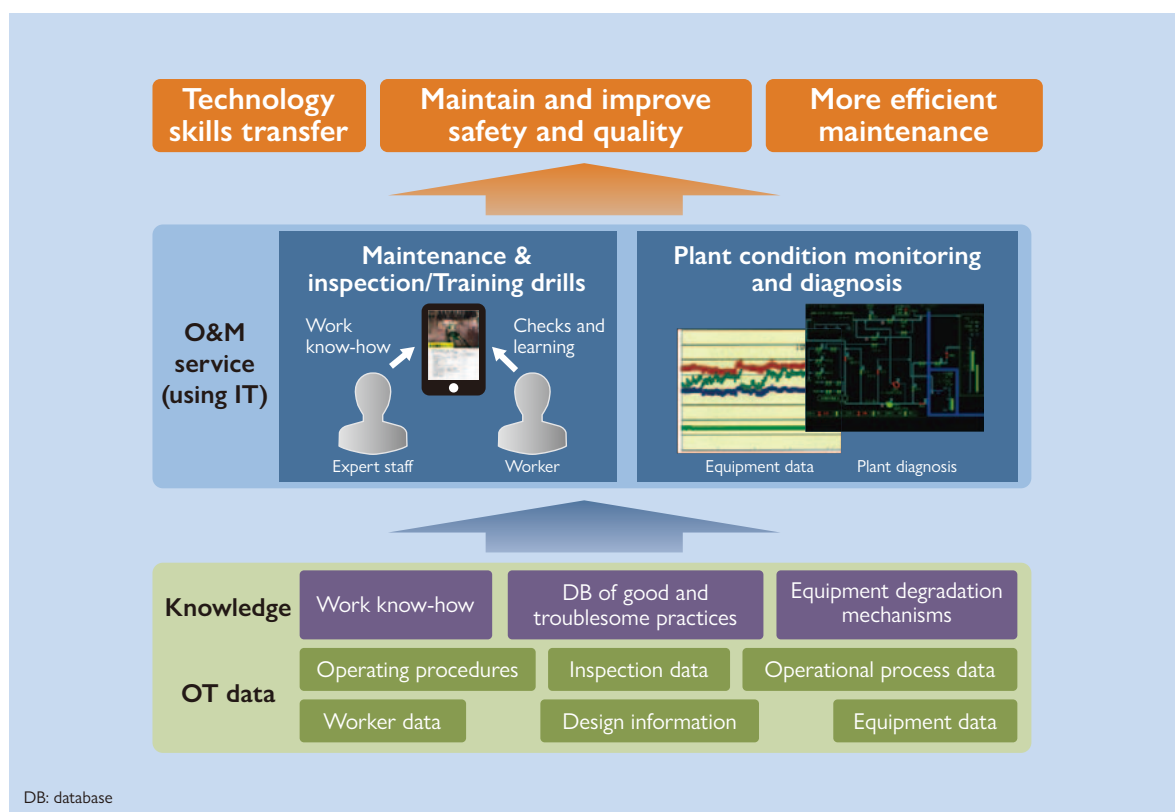
Along with safety enhancements based on the new regulatory standards and new inspection rules being introduced for Japan's nuclear power plants, Hitachi-GE Nuclear Energy, Ltd. is also working on developing and providing solutions that improve the efficiency of operation and maintenance (O&M). Nuclear power plants in Japan need to find ways to deal with the increase in the volume of equipment covered due to safety enhancements, insufficient experience of field workers as a result of extended outage periods, and an aging workforce. Hitachi has set out to make maintenance more efficient without compromising safety by developing techniques for monitoring plant and equipment conditions based on equipment know-how acquired through manufacturing activities as well as operation, inspection, and other operational technology (OT) data. With regard to the aging

workforce and insufficient experience of field workers, Hitachi is utilizing ways of combining ethnographic research^{*} with information technology (IT) in the form of augmented reality or virtual reality (AR or VR) to uncover details of how work is done that existed previously as tacit knowledge, and also to encourage technology skills transfer, keep workers safe, and improve work efficiency and quality. In the future, Hitachi intends to continue contributing to improving O&M at nuclear power plants through the use of IT and OT.

(Hitachi-GE Nuclear Energy, Ltd.)

* Ethnographic research is an approach to social science that performs detailed observation of people's actual behavior with a product or service, which is then analyzed qualitatively.

Source: K. Kashimura et al., "Design Approach Based on Social Science for Social Innovation Business," Hitachi Review, 63, pp. 21–32 (Nov. 2014).



2 Contribution to Improving O&M at Nuclear Power Plants

3 Efficient 3D-CAD Production Technique Using Point Cloud Data

Hitachi-GE Nuclear Energy, Ltd. uses point cloud data in its engineering, procurement, and construction operations, with applications that include dimensional measurement for the installation of new pipe routing at a plant, three-dimensional computer-aided design (3D-CAD) work, and the preparation of working drawings.

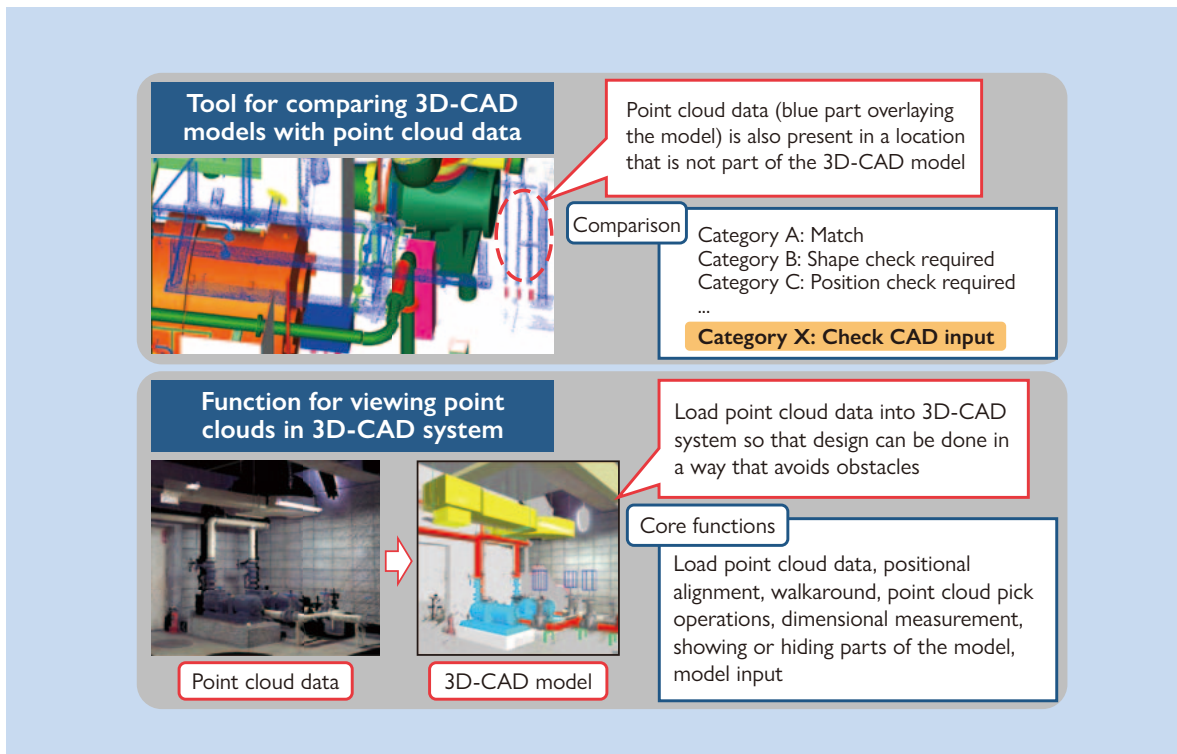
As reducing the amount of work required to produce 3D-CAD models from point cloud data is a major issue in the design process, Hitachi has developed the following two tools for overcoming the bottlenecks of modeling and the visual work that designers need to go through when producing as-built 3D-CAD drawings from point cloud data.

(1) A tool for comparing 3D-CAD models with point cloud data has been developed that identifies where the two match and where shapes or locations differ. The tool analyzes point cloud data using the iterative closest point algorithm to identify the separations and deviations between the data and the 3D-CAD model of a part.

(2) Core functions have been developed to enable point cloud data to be loaded into Hitachi's proprietary 3D-CAD system so that designers can refer to the point cloud while

preparing as-built 3D-CAD drawings. These core functions include loading the point cloud data, positional alignment, walkaround, point cloud pick operations, dimensional measurement, showing or hiding parts of the model, and model input.

(Hitachi-GE Nuclear Energy, Ltd.)



3 Tool for comparing 3D-CAD models with point cloud data and function for viewing point clouds in 3D-CAD system