Developments in the Use of New Technology for Surveys/Inspections Regime

Tokyo, Japan

- Advanced NDT Technology
- Remote Inspection Technique
- Other Technology
- Look into the Future
Advanced NDT Technologies

- Phased Array Ultrasonic Testing (PAUT)
- Time of Flight Diffraction (TOFD)
- Automated Ultrasonic Testing (AUT)

Advantages

- **More Healthy**: No radiation, environment-friendly.
- **Higher Flexibility and Accuracy**: Defects’ position, size, depth can be detected more easily and precisely.
- **More Efficient**: Testing process was significantly shortened by using new scan technology.
- **Image-based**: Inspection result can be displayed as images, easy for analysis.
- **Recordable and Analyzable**: Original inspection data can be saved as digital record. The results are repeatable and traceable off-line.
**Application**

- **Ships**: Butt weld / fillet weld testing
- **Offshore**: Small diameter pipe butt weld testing, crack defect tracing
- **Industry products**: Wind turbine blade testing, fusion depth of U-rib testing, dissimilar steel weld testing.

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- The new advanced NDT technologies are being more and more widely applied by the industry and IACS members. Common requirements (e.g. minimum inspection area, sampling, acceptance criteria, qualification of personnel, etc.) for shipbuilding and ship survey are needed by the industry.
- Following IACS documents are not applicable to advanced NDT technologies and may need to be scrutinized/updated:
  - UR Z16 - Periodical surveys of cargo installations on ships carrying on liquefied gases in bulk
  - UR Z17 - Procedural requirements for service suppliers
  - UR Z23 - Hull Survey for New Construction
  - UR S33 - Requirements of use of extremely thick steel plates in Container Ships
  - UR W1 - Materials and welding for gas tankers
  - REC20 - Non-destructive testing of ship hull steel welds
  - Etc.
Remote Inspection Technique (RIT) is the method that obtains information of an object, by the use of real-time sensing devices (such as camera, video, scan device) carried by:

- Drone
- Remote Operated Vehicle (ROV)
- Unmanned Robot Arm
- Climbers
- Divers etc.

Nowadays, the application of RIT (in particular drone) in ship survey becomes more common.
RIT in Marine

- Class Societies have conducted survey using RIT and published relevant guidelines
- Underwater damage inspection
- Ship dynamic management
- Pollution monitoring
- Control of the ship concentration

Advantages:
- Confined/Hazardous space inspection
- High efficiency
- Recording
- Information feedback in a timely manner

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Guidelines for Use of Remote Inspection Techniques for surveys

1. General

1.1 Definitions

Remote inspection techniques may include the use of:
- Divers
- Unmanned robot arm
- Remote Operated Vehicles (ROV)
- Cameras
- Sonars
- Other means acceptable to the Society.

1.2 When permitted remote inspection technique may be used to facilitate the required external and internal examinations, including close-up surveys and gauging. The methods applied for remote inspection technique are to provide the survey results normally obtained for by the Surveyor.

The results of the surveys by remote inspection techniques when being used towards the crediting of surveys are to be acceptable to the attending Surveyor. Inspections should be carried out in the presence of the Surveyor.

1.3 Confirmatory surveys/close-up surveys may be carried out by the Surveyor at selected locations to verify the results of the remote inspection technique.

Confirmatory thickness measurements may be requested by the attending Surveyor appropriately.

An inspection plan for the use of remote inspection technique(s), including any confirmatory surveys/close-up survey/thickness measurements, is to be submitted for review and acceptance in advance of the survey.
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• Latest changes to the Rec. 42 (Rev. 2, June 2016)
  
  • 1 General
    
    1.1 Definitions: Remote inspection techniques may include the use of:
    
    Divers, Unmanned robot arm, Remote Operated Vehicles (ROV), Climbers, Drones, and Other means acceptable to the Society.
    
    1.2 When permitted remote inspection technique may be used to facilitate the required external and internal examinations, including close-up surveys and gauging.
    
    The results of the surveys by remote inspection techniques when being used towards the crediting of surveys are to be acceptable to the attending Surveyor. Inspections should be carried out in the presence of the Surveyor.
    
  • 3. Procedures
    
    3.1 Prior to the commencement of surveys, a pre-meeting should be held between the technician(s), the owner’s representative(s) and the attending Surveyor(s) for the purpose to ascertain that all the arrangements detailed in the inspection plan are in place, so as to ensure the safe and efficient conduct of the inspection work to be carried out.
    
    3.3 Expanded requirement on Visibility to allow for a meaningful examination.

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• Is it possible that the collected information by RIT becomes the basis of issuance/endorsement of a class/statutory certificate? If yes, under what provisions?

• Common and more detailed requirements (such as scope of application, provisions for equipment/appliances, conditions for acceptance of the data collected by RIT, personnel qualifications etc.) for survey during new construction and in-service are needed.
• Besides Rec. 42, following URs may also need to be scrutinized/updated to introduce RIT technology:
  • UR Z3 - Periodical survey of the outside of ship’s bottom and related items
  • UR Z7.1 - Hull surveys for General Dry Cargo Ships
  • UR Z7.2 - Hull surveys for Liquefied Gas Carriers
  • UR Z10.1 - Hull surveys of Oil Tankers
  • UR Z10.2 - Hull surveys of bulk carriers
  • UR Z10.3 - Hull surveys of chemical tankers
  • UR Z17 - Procedural requirements for service suppliers
  • Etc.
Other Technologies

- Following new technologies may also be used for ship inspection in the future and relevant Guidelines/Recommendations may need to be developed:
  - Remote Monitoring
  - Condition-based Maintenance/Inspection
  - Design of Network/Cyber Platform
  - Other proposal to be identified in the future (if any)

Look into the Future
Will the real time Remote Monitoring/Diagnosis/Inspection techniques (as a function of Intelligent/Smart Ship) be accepted as the basis for issuance/endorsement of a certificate?

Is it possible that Remote Monitoring/Inspection System of hull and machinery (data collection/transfer/analysis) be a new mode of ship survey in the future?

Will RIT be combined with NDT? What do such more and more powerful remote monitoring/inspection techniques mean to Class Societies & Industry?

Thanks for your kind attention!