

**IHE-RO Technical Committee  
Virtual Face-to-Face  
April 6-9, 2020 at 8:30-5:30 EDT  
April 10 8:30-12:00 EDT**

**Technical Committee Chairs:  
Scott Hadley, PhD  
Chris Pauer**

**IHERO Working Group Co-Chairs  
Bruce Curran, MS, ME, FAAPM, FACMP, FACR, AAPM / VCU Health  
Bridget Koontz, MD, Medical Director, RO Services, Duke Regional**

**Mission Statement:** *The American Association of Physicists in Medicine (AAPM) sponsors a multi-society Task Force to undertake an initiative to promote the Integration of the Healthcare Enterprise (IHE) – Radiation Oncology (RO). Originally formed by the American Society for Radiation Oncology (ASTRO), it fosters seamless connectivity and integration of radiotherapy equipment and the patient health information systems. The Technical Committee of IHE-RO will undertake use cases defined by members from ASTRO, RSNA, American Association of Physicists in Medicine (AAPM), the American College of Radiology (ACR) and the Medical Imaging and Technology Alliance (MITA). In addition, members of the International community have also been invited to participate in IHE-RO. The IHE-RO Task Force, in close collaboration with radiotherapy product manufacturers, will develop appropriate integration profiles for radiation therapy and setup a demonstration of seamless communication among the full array of radiotherapy products.*

**Attendees:**

Name	Affiliation	Email	4/6	4/7	4/8	4/9	4/10
Chris Pauer	Sun Nuclear	<a href="mailto:chrispauer@sunnuclear.com">chrispauer@sunnuclear.com</a>	X	X	X	X	X
Scott Hadley	U. Mich.	<a href="mailto:shadley@umich.edu">shadley@umich.edu</a>	X	X	X	X	X
Walter Bosch	Wash. Univ.	<a href="mailto:wbosch@wustl.edu">wbosch@wustl.edu</a>	X	X	X	X	X
Jill Moton	AAPM	<a href="mailto:Jill@aapm.org">Jill@aapm.org</a>	X	X	X	X	X
David Wikler	IBA	<a href="mailto:David.Wikler@iba-group.com">David.Wikler@iba-group.com</a>	X	X	X	X	X
Harold Beunk	ICT	<a href="mailto:Harold.Beunk@ict.nl">Harold.Beunk@ict.nl</a>	X	X	X	X	X
Thomas Schwere	Varian	<a href="mailto:Thomas.Schwere@varian.com">Thomas.Schwere@varian.com</a>	X	X	X	X	X
Bob Pekarek	Accuray	<a href="mailto:bpekarek@accuray.com">bpekarek@accuray.com</a>	X	X		X	X
Jim Percy	Elekta	<a href="mailto:Jim.percy@elekta.com">Jim.percy@elekta.com</a>	X	X	X	X	X
Bruce Rakes	Mevion		X	X	X	X	X
Richard Voegele	Brainlab	<a href="mailto:richard.voegele@brainlab.com">richard.voegele@brainlab.com</a>	X				
Stefan Pall Boman	Raysearch Labs	<a href="mailto:Stefan.p.boman@raysearchlabs.com">Stefan.p.boman@raysearchlabs.com</a>	X	X	X	X	X
Rickard Holmberg	Raysearch Labs	<a href="mailto:Rickard.Holmberg@raysearchlabs.com">Rickard.Holmberg@raysearchlabs.com</a>	X	X	X	X	
Jon Treffert	Raysearch Labs/ ProNova	<a href="mailto:Jon.treffert@raysearchlabs.com">Jon.treffert@raysearchlabs.com</a>	X	X		X	X
Chadd Smith	Henry Ford Health System		X	X			
Rishabh Kapoor	VCU/VHA	<a href="mailto:Rishabh.kapoor@va.gov">Rishabh.kapoor@va.gov</a>	X	X			
Sanjay Bari	Elekta	<a href="mailto:Sanjay.Bari@elekta.com">Sanjay.Bari@elekta.com</a>	X	X	X	X	X

Tucker Meyers	EPIC	<a href="mailto:tucker@epic.com">tucker@epic.com</a>		X			
Russ Price				X		X	X
Marcus Bergman	Raysearch Labs			X	X	X	
Martin von Siebenthal	Varian			X			
Bruce Curran	AAPM / VCU	<a href="mailto:bcurran@gmail.com">bcurran@gmail.com</a>				X	X
Yonatan Vainer	Sensus Healthcare				X	X	X
Stina Svensson	Raysearch Labs	<a href="mailto:Stina.svensson@raysearchlabs.com">Stina.svensson@raysearchlabs.com</a>				X	

### Minutes:

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I. Meeting was called to order at 8:47am EDT, April 6, 2020.

#### II. Topic 1: Level Set

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A. Review Agenda – Order and timing for Topics was reviewed to facilitate discussion with key stakeholders.

B. Minutes for the March 19, 2020 TC Teleconference were reviewed and approved without objection.

C. Updates on IHE-RO activities

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1. Planning Committee – monthly meeting canceled
2. Oversight, Steering Committees
3. Domain Coordination Committee

D. AAPM

1. Decision regarding 2020 Annual Meeting is expected by 4/17/20.

E. DICOM WG-7 Update

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1. Supp 199 (Radiation Records) finished reading with WG-06 and is out for Letter Ballot
2. The next meeting is to focus on Supp 160 (Patient Setup).
3. Connecting 1<sup>st</sup> and 2<sup>nd</sup> Gen RT – DICOM Extended SOP Classes to be used to support transitional implementations (esp. for non C-arm modalities)

F. AdvaMed and Standards Effort

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1. The RT3 Machine Description Standard has been published and can be downloaded. The standard currently addresses linacs, but is extensible to include other equipment.
2. IHE-RO could work out Use Cases for RT3.

#### III. Topic 2: TDW-II

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A. David Wikler led the group in a continued discussion of handling of unexpected UPS from last meeting.

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1. The user should be made aware that there is an unsupported UPS, but should not be required to take additional action
  - a. Want user to know there is an unsupported UPS (TDD to display all UPS, including unsupported ones, mark unsupported as distinct, and disable their execution)
  - b. Do not want to require user to actively acknowledge or dismiss unsupported UPS
  - c. Do not want TDD to report unsupported UPS to the TMS.
  - d. **ACTION 200401**: David Wikler to update TDW-II section 3.58.4.2.3 Expected Actions with required info to be displayed by TDD

- 65 2. Level 2 Conformance of OST Storage of RT Treatment Record
- a. If a TDD requires information from the Treatment Record beyond meterset and original plan reference to continue delivery of an interrupted treatment, the OST must support Level 2 Storage of Treatment Records.
  - b. Consensus to add Option for OST to support Level 2 storage of treatment records without extended negotiation by the TDD.
  - 70 c. **ACTION 200402**: David Wikler to update TDW-II to add an Option to the OST Actor to support Level 2 storage of RT (Ion) Treatment Records without extended negotiation by the TDD.
- 75 3. Thomas Schwere presented a proposed Worklist State Recovery procedure to retrieve treatment artifacts from a TDD following a TMS crash. This approach is triggered from the TDD and uses a KOS document, created by the TDD, to reference treatment artifacts.
- a. Other Use Cases for reconciliation need clarification. Further discussion is needed, including triggering of recovery from the TMS.
  - b. State recovery to be discussed further in the treatment workflow subgroup.

80 IV. Topic 3: RO Treatment History (ROTH)

- A. Chris Pauer reviewed a clinical impact statement and notes from the December 2019 TC meeting.
- B. The group discussed Use Cases for RO Treatment History and identified the relevant artifacts to be included. Details were captured in *IHE\_RO\_White\_Paper\_ROTH\_20\_04\_06* document (work in progress).
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  - 1. Re-irradiation of patients with prior RT
  - 2. Mid-treatment transfer between machines
  - 3. Clinical Trial or Registry Data Submission
- C. Chris is investigating IHE-ITI Profiles for transporting RO treatment history datasets (listed in the white paper).
- 90 D. The major challenge is in selecting the documents/information objects that actually reflect how a patient has been treated. This must be driven from the TMS, but must also include detailed treatment planning information.
- E. **ACTION 200411**: Scott to start subgroup to flesh out use cases for the ROTH Profile with input from AAPM members.

95 *[Adjourned for the day 4/6/20 at 12:33pm EDT]*  
*[Resume meeting 4/7/20 at 8:30am EDT]*

V. Topic 4: Brachytherapy Profile

- 100 A. The Brachytherapy subgroup is developing the TPPC-Brachy profile.
- B. New DICOM Content sections were allocated in Volume 3 for RT Structure Set used in Brachytherapy: RT Structure Set for Brachy (7.3.4.2).
- C. Current drafts are *ihe-ro-tppc-brachy\_v2.3* and *ihe-ro-tdrc-brachy\_v2.3*.
- D. Jim Percy is working with Yuri N. and will present updates later in the week.

105 VI. Topic 5: Exchange of RT Summaries (XRTS)

- A. Current draft is version 0.2.1 (2020-01-14).
- B. Cross-Profile Reference to RXRO was discussed: “The RXRO Profile may be used to facilitate the DICOM transactions between the XRTS Prescription Producer (PP) and Results Producer (RP).”
- 110 C. There is currently no specific mappings between DICOM and HL7 content.
  - 1. DICOM RT Physician Intent are organized as *prescriptions*.
  - 2. HL7 Prescription Summary is structured by *site* and *phase*.
- D. The group discussed mappings of data elements in Table X.3.1-4 Exchange of Radiotherapy Summaries.

- 115 1. Mappings to/from DICOM Attributes were discussed. Some HL7 data elements correspond directly to attributes in DICOM RT Physician Intent IOD, RT Plan, etc. Others are maintained as internal state of the TMS, but are not exposed in DICOM instances.
- 120 2. More work is needed to define the source and destination of data elements in XRTS messages. Differences in terminology and data model make this challenging. Mappings are not necessarily one-to-one.
- 125 3. Mappings vs. Translations
- a. A *mapping* will generally have a 1:1 relationship between an HL7 element or got through some simple formatting transformation to be a 1:N mapping, but the content will be the same.
  - b. In a *translation*, the data represented in HL7 is not the same on the RO/DICOM side, but there is a responsibility to track values in parallel, i.e., a problem ID or code to a Conceptual Volume UID.
- E. **ACTION 200403**: Rishabh to bring the mapping concepts to HIS working group and attempt to incorporate in the XRTS Profile draft.

130 VII. Topic 2.5: Revisit priorities

- A. In Dec 2019, the TC identified five Profile development priorities: XRTS, DRRO, TDW-II, FDII, ROTH
- B. Publication of the RT3 Standard by AdvaMed presents new opportunities to improve interoperable communication of machine configurations.
  - 135 1. Use cases for RT3 identified by Jim Percy (see 4/6/20 email from Jill Moton).
    - a. Treatment machine vendors can digitally publish their geometric specifications; other systems can import these specifications.]
    - b. Geometric models can be compared between different systems (TPS to OIS for example)
    - c. Customer models can be compared by vendor support teams
    - 140 d. Periodic QA by customers of their model to see if something has changed
    - e. Customers can compare models from release to release
    - f. Provides a Unique identifier stamp of the current machine model that can be added to DICOM plans or records
  - 145 2. Questions discussed:
    - a. How can these uses serve to improve patient safety? (FDA priority)
    - b. How can the standard be tied into existing Profiles? other clinical processes?
    - c. What transport mechanisms should be used to communicate RT3 specifications?
    - d. Is it helpful to define the linkage between treatment techniques (e.g., TDPC beam types) and RT3 specifications?
    - 150 e. Calibration model for machines is included. How can this be used to ensure consistent dosimetry?
    - f. Define a “Consistent Calibration” Profile? Update TPPC? TDPC? TDRC?
  - 3. Treatment delivery vendors can begin building and publishing specifications for their machines.
  - 155 4. **ACTION 200404**: Bruce Curran to solicit interest in AAPM IT Working Group and others in developing a library of machine configuration specifications.

*[Adjourned for the day 4/7/20 at 12:31pm EDT]*

*[Resume meeting 4/8/20 at 8:30am EDT]*

160 VIII. Topic 8: Sim to Setup Shift (SSS)

- A. Thomas Schwere reviewed setup shift concepts with the group.
- B. This Profile is used to communicate iso-center shift(s) for treatment setup (i.e., offset from tattoos to real treatment isocenter). This process may involve multiple setups.
- C. Terminology: patient setup is a three-step process.
  - 165 1. Setup = patient placed on table

2. Alignment = patient shifted to treatment isocenter
3. Image guidance = correction of position using imaging
- D. For each isocenter, use optional DICOM attributes: Table Top {Vertical, Longitudinal, Lateral} Setup Displacement.
  - 170 1. These shifts are applied in the “alignment” step.
  2. When optical surface guidance is used, these shifts are not used.
- E. Multi-iso-center plans are used clinically to facilitate compositing of dose from all iso-centers. This may require multiple IGRT acquisitions to correctly position widely separated targets.
- F. The scope and semantics of Patient Setup UID remains an open issue in DICOM Supp 160. (This topic is to be addressed in the next WG-07 meeting starting on 4/27/20.)
- 175 G. One option is to include this information as part of the RT Plan (and/or RT Structure Set) content in TDPC.

#### IX. Topic 2.5: RT3 Revisited

- 180 A. (No additional actions taken.)

#### X. Topic 9.2: Other DICOM updates

- A. There are concerns regarding the paucity of implementations of DICOM secure connections.
- B. How can improved support for Encryption of DICOM connections and support for Unicode text be promoted in IHE-RO?
- 185 C. What are testing issues?
  1. Need test datasets with Unicode strings.
  2. This has implications in display, text entry, storage, and transformation of attributes.
  3. Display requirements for DICOM attributes
  - 190 4. ISO IR-192 data
- D. Can character set support be separated from other interoperability concerns?
  1. Are DICOM VR rules for use of UTF-8 encoded Unicode sufficient? Is there a need to further restrict those attributes for which Unicode strings can be used? All names, labels, descriptions?
- E. Cross-Domain Concerns
- 195 1. What implications are there for RO-domain Profiles of solutions to security and character-set support?
- F. **ACTION 200405**: Chris to draft a response by 4/17/20 to WG-07 and IHE on the response to security and character set support issues raised by Christof Schadt.

#### 200 XI. Connectathon Results

- A. Concern has been expressed regarding Actors that pass Test Tool evaluations and peer-to-peer testing with a single test partner. They have not failed, but cannot pass, due to insufficient test partners.
  1. Is there a category for reporting those actors that pass with a single test partner and clean evaluation with test tools?
  - 205 2. Is there a way to incorporate prior successes, i.e., passing with a previous version of a product?
  3. **ACTION 200406**: Walter Bosch to seek clarification from IHE Testing and Tools Cmte (Lynn Felhofer, Phil Depalo) on appropriateness of reporting partial success (i.e., test success with single test partner).
- B. Products tested in a Connectathon are engineering versions, not released version. The Integration Statement should reference the version tested and indicate the corresponding released version.
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#### XII. Topic 10: 4D Image Import

- A. **ACTION 2004007**: Scott Hadley to request an update from Michael Owens regarding the status of IHE-RAD discussions on 4D image handling.
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#### XIII. Topic 11: Query Retrieve in RO (QRRO) No update here, but just a check in and level set

- A. Stefan Boman summarized the status of QRRO from the Hayward meeting. The QRRO Profile is to focus on relational queries.
- B. ACTION 200408: Chris Pauer to update Uli Busch on the status of the QRRO Profile development.

[Adjourned for the day 4/8/20 at 12:20pm EDT]

[Resume meeting 4/9/20 at 8:34am EDT]

#### XIV. Topic 13: Deformable Registration

- A. Stefan Boman reviewed an updated version of the DRRO Profile draft (ihe\_ro\_drro\_0.6) with the TC.
  - 1. Re-use of Structure Set Storage Transaction was considered. Consensus that no special requirements need be applied to RT Structure Set Storage.
  - 2. The DRRO Profile involves content and workflow aspects. Emphasis is on Content, but we still need Transactions. There is no managed workflow.
    - a. Actor Diagram
    - b. Actors and Transactions Table – need to specify Options. E.g., Registrator optionally retrieves RT Structure Set and Spatial Registration instances.
    - c. Actors and Content Module Table references Content Modules
  - 3. Sequence Diagrams
    - a. If Actors work independently, as they do in MMRO-III, then all transactions are between the Actors and an Archive or Cloud. In this case, the sequence diagram is not helpful and can be omitted.
  - 4. Actor Groupings
  - 5. Volume 3 Content
    - a. Deformable Spatial Registration Module is type “R”.
    - b. Content requirement for attributes in DICOM Macros: It would be helpful to indicate/delimit the attributes within DICOM Macros that have IHE requirements. Could use “End Macro” indicators.

#### XV. Topic 4: Brachytherapy Profile (continued)

- A. Jim Percy reviewed changes to the TPPC-Brachy Profile to add RT Structure Set Producers and Consumers. At least two types of structure sets for brachytherapy were considered:
  - 1. HDR and PDR – applicators, channels
  - 2. Permanent LDR – source (seed) locations
  - 3. Temporary LDR – sources (same as Permanent LDR?)
- B. The TC discussed use and reuse of Transactions for TPPC-Brachy.
  - 1. In current usage, Transactions may be reused only if they involve the *same Content*.
  - 2. For treatment planning (TPPC-Brachy), the Plan Producers have two required Transactions: one for RT Plan Storage and one for RT Structure Set Storage
  - 3. For treatment delivery (TDPC-Brachy), the Plan Producer has only one Transaction involving RT Plan Storage.
- C. Content requirements for Modules: unless otherwise specified, the Basic Interoperability Requirements in Section 7.4.1 Apply.

#### XVI. Topic 13.5: Sensus Healthcare – Getting Started in IHE-RO

- A. Russ Price (Sensus CTO) presented an overview of Sensus Healthcare products
  - 1. Sculptura (Intra-op electron beam using tungsten-coated diamond device)
  - 2. Balloon applicator contacts tissue to be treated. Image of balloon is used to create treatment plan.
- B. Yonatan Vainer discussed the Sensus Treatment Planning System
  - 1. Currently, treatment planning is fully integrated within the Sensus system.
  - 2. Sensus has its own, simple EMR, but they are interested in connectivity with other.
- C. Interoperability Issues

1. Enable other systems keep a record of what was treated and to what dose.
2. Sensus plans to import pre-op DICOM CT Images to register with intra-op
3. Internally uses 3D images, contours, doses – what is needed is to represent plans sufficiently in DICOM 1<sup>st</sup> Gen (“stub plan”). This could be derived from phantom data.

D. Further discussion and next steps tomorrow

*[Adjourned for the day 4/9/20 at 12:30pm EDT]*

*[Resume meeting 4/10/20 at 8:32am EDT]*

E. Onboarding of new companies

1. What interoperability concerns will you have to deliver your device's services?
2. What interoperability concerns would a customer have when using your device?

F. Connectivity Use Cases of Sensus Healthcare products

1. Possible Use Cases
  - a. Import patient images
  - b. Export Sensus images, structures, dose for plan assessment, continuity of care, re-treatment
  - c. Dose delivery recording
  - d. Capture of plan information for billing
  - e. Plan information for secondary meterset check before treatment
2. Import/Export of images, structure sets, dose is likely to have high priority
3. IHE-RO Profiles, e.g., BRTO-II define requirements for interoperable exchange of images, structures, dose.
4. Next step is to define content of a “stub plan”.

XVII. Topic 14: Basic QA Workflow (BQAW)

- A. Chris Pauer presented an updated draft of the BQAW Profile (BQAW\_20\_04\_08\_v0.10).
- B. Instances to be evaluated are pushed from the Data Provider to the QA Performer.
- C. Raw Data Storage is used to encapsulate proprietary data. The Creator-Version UID (0008,9123) identifies the schema (equipment and version of software that created the raw data).
- D. Optional KOS instance (sent after all other instances)
  1. Acts as manifest of instances to be evaluated
  2. Storage of KOS is trigger event for QA workflow
- E. Content requirements for KOS Storage in BQAW were reviewed by the group.
- F. Current Requested Procedure Evidence Procedure
- G. **ACTION 200409**: Chris to request time with DICOM WG-07 to discuss usage of KOS
- H. **ACTION 200410**: Chris to update BQAW Profile with results of TC discussions

XVIII. Topic 15: Future Meetings

- A. After AAPM Annual Meeting – July 15-17, 2020, Virtual meeting July 15-17, 2020, 9:30am – 1:30pm ET
  - a. Originally scheduled for Vancouver, BC, Canada (Wed 8:30am – Fri 5:30pm)
  - b. AAPM Educational Session – Mon., July 13, 2020, 2:45-3:45pm (timezone?)
- B. Profile Development – Oct 5-9, 2020, currently scheduled at IBA, Brussels, Belgium (fall back to AAPM HQ, Alexandria, VA)
- C. Fall 2020 Connectathon – Nov 16-20, 2020, NEMA HQ, Arlington, VA, Nov 21, 2020 Connectathon wrap-up (½ day)
- D. Next monthly TC Teleconference is May 21, 2020
  1. Logistics and agenda for July meeting
- E. IHE-RO Planning Committee meets on 4<sup>th</sup> Tuesday of the month at 2:00pm
- F. IHE-RO Working Group meets 2<sup>nd</sup> Tuesday of the month at 2:00pm

XIX. Topic 16: Review and Wrap Up

XX. Meeting was adjourned 4/10/20 at 11:50am ET