IHE-RO Technical Committee
Face-to-Face
Session 1
January 31, February 1, 2022, 9:00-13:00 EST
Session 2
February 14-15, 2022 9:00-13:00 EST

Technical Committee Chairs:
Scott Hadley, PhD
Jon Treffert

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	1/31	2/1	2/14	2/15
Scott Hadley	U. Mich.	swhadley@umich.edu		X	X	X
Jon Treffert	Raysearch Labs	Jon.treffert@raysearchlabs.com	X	X	X	X
Jill Moton	AAPM	Jill@aapm.org	X	X	X	X
Walter Bosch	Wash. Univ.	wbosch@wustl.edu	X	X	X	X
Bruce Curran	AAPM / VCU	bhcurran@gmail.com	X	X	X	X
Jim Percy	Elekta	Jim.percy@elekta.com	X	X	X	X
Bruce Rakes	Mevion	rbrakes@mevion.com	X	X	X	X
Harold Beunk	ICT	Harold.Beunk@ict.nl	X	X	X	X
Bob Pekarek	Accuray	bpekarek@accuray.com	X	X	X	X
Richard Voegele	Brainlab	richard.voegele@brainlab.com	X	X	X	X
Christof Schadt	Brainlab	Christof.schadt@brainlab.com	X		X	
Stefan Pall Boman	Raysearch Labs	Stefan.p.boman@raysearchlabs.com	X	X	X	
Sanjay Bari	Elekta	Sanjay.Bari@elekta.com	X	X	X	X
Marcus Bergman	Raysearch Labs	Marcus.bergman@raysearchlabs.com	X	X	X	X
David Wikler	IBA	David.Wikler@iba-group.com		X	X	X
Thomas Schwere	Varian	Thomas.Schwere@varian.com	X	X	X	X
Naveen Lakshmana	Philips	naveen.kumar.lakshmana@philips.com		X	X	X
Tucker Meyers	Epic	tucker@epic.com		X	X	X
Martin von Siebenthal	Varian	martin.vonsiebenthal.com			X	
Rishabh Kapoor	VCU/VHA	Rishabh.kapoor@va.gov				X
Michelle Casagni	Mitre	mcasagni@mitre.org				X
Anthony DiDonato	Mitre	adidonato@mitre.org				X

Minutes:

IX. Meeting was called to order 1/31/22 at 9:06 am ET. A quorum was present.

35   X. Meeting Scope
- A. Minutes from the Jan 20, 2022 TC teleconference were reviewed and approved without objection. (Motion: Harold, Second: Jim)
- B. Review Agenda

40   XI. Topic 1: CPs for consideration – Christof Schadt presented recently approved CPs from WG-07, currently in Final Text in DICOM.
- A. CP 2150 Add OAR to RT ROI Interpreted Type
  1. Addition of the OAR Defined Term may have implications for BRTO-II.
  2. Inconsistent usage of the RT ROI Interpreted Type has been a barrier to interoperability in testing. No
45   constraint on usage is currently present in BRTO-II.
  3. Discussion of strategy for incorporating constraints on ROI Types.
     a. Options include (a) adding content requirements for RT ROI Interpreted Type or (b) requiring coded representation for ROI Types. (DICOM CP 2151 adds Segmentation Property Category Code to the RT Structure Set and is expected to be incortported into the DICOM Standard (2022b).)
50   b. Simply adding the "OAR" Defined Term to the list of RT ROI Interpreted Type values in BRTO-II (Section 7.4.8.1.1.2) was *not recommended*.
     c. Consensus of the TC that Connectathon judges should tolerate a range of usage of RT ROI Interpreted Type values. I.e., not issue Finding for Producers that satisfy (syntactic) content requirements.
     d. Add "handle safely" message for Consumers to check Interpreted Types of "ORGAN",
55   "AVOIDANCE", and "OAR". Recommend mapping received data to appropriate types.
     e. May add clarification of RT ROI Interpreted Type semantics in future version of BRTO Profile.
  4. Proposal to accumulate issues for Profile updates, including the following
     a. Incorporation of DICOM CPs
     b. Review of display requirements for DICOM content
60   c. Mandates for visualization of data in clinical systems
  5. ==ACTION 220101==: Christof Schadt to compile a list of DICOM CPs for review by the TC.
- B. CP 2152 Add Plan Overview Parameters to RT Dose
  1. Dose Displayer can use this content in the absence of an RT Plan
- C. CP 2153 Add Linac Calibration Parameters to Treatment Plan
65   1. Commissiong Key to be preserved in treatment planning (TPPC) and recorded for deliveries (TDRC)
  2. Discussion of implementation strategy. Requires either a new Option (new Transactions) or a new version of the TPPC Profile.

XII.   Topic 2: Treatment Record Content Presentation
70   A. Jim Percy presented issues pertaining to requirements for visualization in TDRC-Brachy.
  1. This is not a content requirement *per se*, but specification of how plans are displayed to users.
  2. Discussion of the relationship between requirements for display of attributes in the Profile and the manner in which they are displayed by an application. Testing is based on a demonstration that content is represented in a clinically consistent manner. This is dependent on the Use Case of the producer or
75   consumer Actor.
  3. ==ACTION 220102==: Jim Percy to draft proposal for specifying display requirements in TDRC-Brachy Volume 2.

XIII.   Topic 3: IHE-RO Web Presence/Tools
80   A. Discussion of current tools and opportunities to simplify.
  1. DocuWiki (ihe-ro.org) – Profile documents and Connectathon instructions
     a. Current hosting is paid through Dec 2022
     b. Possible alternatives
        i   Github (with open-source front-end)

85   ii   AAPM Allegiant system (new Content Management System) – implementation is expected later in 2022. Bruce to explore possibilities with Michael and Farhana.

                 iii CNI – AAPM IT vendor – bundling with other services (VPN, cloud server) may be advantageous.

       2. Box.com

         a. Currently working well for document sharing and storage of test data, e.g., DRRO.

90   3. IHE – (ihe.net) IHE home page, public landing page for RO Domain

[Adjourned for the day 1/31/22 at 12:38pm ET]
[Resume meeting 2/1/22 at 9:04am ET]

95   XIV.   Meeting Scope

       A. Review Agenda

    XV.   Topic 5: Workflow Next Steps (TDW/DPDW)

       A. TDOR status

100   1. Thomas Schwere reviewed the status of TDOR Profile (vers. 0.5) with the group. The Deferred Recording Process Flow was presented. (Additional sequence diagrams for variations to this process are in preparation.)

         a. A Discontinuation Reason Code for Deferred Recording still needs to be added to DICOM.

         b. N-Create of Record Treatment Session allows for various OST/TMS contexts.

105   c. TDD creates a UPS to perform offline recording of a treatment session

       2. Whether to define a new Actor for offline recording or extend requirements to the TMS Actor was discussed.

         a. David Wikler presented an overview of the IHE-RO Process System Architect Perspective. Architecture is driven by the PC. The TC specifies solutions using existing standards. Actors are

110   described at a high level and may play different roles in different Profiles.

       3. Offline recording in TDOR requires TMS to include Scheduled Treatment Session UID in the UPS N-CREATE. This cross-Profile requirement also applies to IPDW. Decision to express this requirement as an extra content requirement in TDOR (rather than as an extension of TDW-II).

115   B. Discussion of Profile architecture in delivery workflow.

       1. Issues include granularity of Actors and instructions (plan-level vs. beam-level).

       2. Engagement with imaging and positioning vendors.

       3. <mark>ACTION 220103</mark>: Jon to solicit input from TC and organize meeting with imaging and positioning partners. Include surface imaging.

120   4. <mark>ACTION 220104</mark>: Jon to schedule an single-topic meeting after AAPM annual meeting to discuss imaging and positioning; publicize and invite third-party vendors at AAPM.

       C. Varian VTI status

       1. VTI is FHIR-based. Several implementations have been developed. Use of FHIR for workflow

125   management was discussed. The DICOM and FHIR standards have complementary advantages and challenges. DICOM works well for persistent representation of immutable data, but has difficulty managing status updates. FHIR is extensible and supports status updates and instructions (Resources can be used for scheduling and process control); but persistent data must be managed carefully.

       2. Use Cases:

130   a. Online Adaptive

         b. Discrete Devices

    XVI.   Topic 6: Committee Updates

       A. DRRO

135   1. Test Workshop/Test Tools – Walter Bosch reported.

         a. A workshop for informal testing of the DRRO Profile is scheduled for April 11-13, 2022. The focus of the workshop is development of test methods. Dan Polan (UMich) is drafting test procedures.

	b.	Test data to evaluate proper encoding and interpretation of the Deformable Spatial Reg IOD has been developed and circulated in the DRRO group. Several issues have already been identified and corrected in vendor applications.
	c.	Demcom is extending the IHE-RO Content Validator to evaluate DRRO requirements for Deformable Spatial Registration IOD content. Content requirements for images, RT Structure Set and RT Dose are expected to be the same as for BRTO-II.

B. XRTS
1. Next Workshop is tentatively scheduled for May 9-11, 2022.
2. Some concern remains regarding HIS systems' ability to support subscription to a Repository.
3. Current emphasis is on message content. This is a work in progress.

XVII. Topic 7: Next Meetings/Presentations/Deliverables
    A. F-F Session 2 Agenda
        1. Suggested topics
           a. TDRC-Ion (treatment and setup beams)
           b. TPPC-Brachy
           c. TDRC-Brachy
           d. TDW-II (edit for FT)
           e. TDOR (added requirement for TDW-II)
           f. ROTH
           g. BQAW
           h. HDSS (High-Def Structure Set) – Richard Voegele to present

    B. AAPM
        1. Planning Committee Presentations
           a. TDW/DPDW February 15
               i   ==ACTION 220105==: Jill to invite DPDW Committee to PC presentation.
           b. TDIC March 15
               i   ==ACTION 220106==: Jon to work with David to prepare agenda for TC F2F in Feb.
        2. 2022 Deliverables

XVIII. Sesion 1 was adjourned at 11:55am ET

XIX. Session 2 was called to order 2/14/22 at 9:03 am ET. A quorum was present.

XX. Meeting Scope
    A. Review Agenda
    B. Minutes from Session 1 (1/31/22, 2/1/22) of this meeting were approved by the Technical Committee without objection.

XXI. Topic 1: HDSS (High Definition Structure Sets)
    A. Richard Voegele and Christof Schadt discussed the use case for high-definition structure set. "Unattached contours" may be defined in arbitrarily-oriented (non-axial) parallel planes. Orientation and spacing may vary across ROIs to optimize definition.
        1. Examples comparing volumes and (DVH computed from HD dose) for SD and HD structures were shown. Relative differences between original volumes and the volumes of exported and re-imported structures for SD and HD representations were compared. Relative differences as high as 30% were seen in SD structure sets. Differences in HD structure sets were very small.
        2. It was proposed to require the Source Pixel Planes Characteristics Sequence (3006,004A) to be present (per ROI) if and only if the ROI is transmitted as an HD contour.
        3. Proposal to include the Image Orientation (Patient) (0020,0037) attribute in the Source Pixel Planes Characteristics Sequence (3006,004A) to indicate the orientation of the contours for an ROI in the Frame of Reference of the Structure Set. This attribute is Type 1 within a Type 3 Sequence. It may already be required by the Standard if the Source Pixel Planes Characteristics Sequence.

        4. Discussion of Pixel Spacing, Spacing Between Slices, Rows, Columns, and Number of Frames Attributes in the Source Pixel Planes Characteristics Sequence. These attributes are Type 1. They represent pixel spacing and counts *in the source system* and may not coincide with the spatial parameters *in the consuming system* (may be rendered in a different orientation).

        5. The Spacing Between Slices (0018,0088) attribute is used to detect gaps in a structure, i.e., to determine whether successive contours are contiguous.

    B. The decision to proceed with development of a HDSS Profile was tabled.

        1. Limitations on references to Image Instances in the Contour Image Sequence were discussed briefly, but were considered to be outside the scope of the HDSS topic. This issue, along with other RT Structure Set related concerns, e.g., Contour Geometric Type values of CLOSEDPLANAR_XOR, will need to be discussed separately.

        2. Content-related material appears to be well defined. Further discussion of implementations and implications for other Profiles is to follow.

II. Topic 2: Use Case: Exchange of mCode resources with Patient Data

    A. Tucker Meyer reviewed an example of a Patient Condition resource for cancer with stage.

        1. Many custormers want ot enter diagnoses and stages just one and see them in all relevant systems (HIS, ROIS).

        2. Diagnosis and stage are already in mCODE.

        3. Diagnosis may be transferred from EHR to OIS or from OIS to HER.

        4. How to identify the Diagnosis was discussed. What elements of diagnosis are needed? Instance of the condition report and FHIR Resource, diagnosis code. The FHIR resource may be updated as the patient's condition changes. A prescription needs to reference a disease report, rather than a changing condition.

    B. What other elements beside diagnosis code and staging are needed for creating or updating a prescription or manage treatment of a patient?

    C. Current implementations (EPIC, Varian) have FHIR interfaces that respond to queries (create resources), but do not store data internally as FHIR. Accepting diagnosis information appears to require implementation of subscription.

    D. Discussion of architectural options: exchange of patient condition could be an extension to XRTS.

    E. mCODE is a US-based coding scheme. Is mCODE the correct solution for exchanging RO information? Is this acceptable as an international coding scheme?

    F. <mark>ACTION 220201</mark> Jon to bring Patient Condition/Diagnosis Use Case forward to PC

    G. <mark>ACTION 220202</mark> Tucker to discuss addition of Diagnosis Use Case as XRTS extension in HIS subcommittee.

III. Topic 3: AAPM Survey – new Use Cases?

    A. Jon Treffert reviewed results of the AAPM "2021 IHERO Survey combined v3.xlsx" with the TC. Surveys were distributed both within AAPM membership and to a broader (international) community. The purpose of the exercise was to identify Use Cases that have not been covered well. Interoperability issues discussed include the following:

        1. Mismatch of beam machine among TPS, OIS, TDS – RT3 model, calibration key in TPPC

        2. Image guidance, transfer of reference images – TDW extension to imaging, 3rd party devices

        3. Couch coordinate transfer from TPS to OIS – TDPC/TPPC absolute table top displacement

        4. Inability to transfer plans among delivery systems due to limited support for the same delivery parameters

        5. Discrete imaging/positioning system integration

        6. Imaging review interface issues in OIS

        7. Ultrasound image transfer for prostate HDR – TPPC Brachy (US/MR registration)

        8. Multi-isocentric dataset (TPPC) – could be used for TDPC

        9. Mismatch of patient demographics in OIS, SIM, TPS, imager / patient data coercion (Modality Performed Procedure Step)

        10. Gantry, couch positioning for imaging – Imaging instruction

        11. Export of SRO used for registration of CBCT – ROTH / TDIC

        12. Portal dosimetry – what is needed to use DICOM for this?

        13. TPPC – multiple contours for one physical block

245   14. Implementation limitations: #contours, #points, #ROIs – BRTO-II defined parameter limits – is a new test case needed? Contours may not be reuired at TDD.

        15. Support for special characters – ISO IR 100. – This is a practical issue (impediment to interoperable exchange).

        16. Image Instruction related – Imaging workflow integration

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[adjourned for the day 2/14/22 at 1:02pm ET]
[resume meeting 2/15/22 at 9:04am ET]

IV. Committee Updates

255   A. Results of the 2021B IHE-RO Connectathon have been accepted by the IHE International Board.

V. Topic 4: TDRC

    A. David Wikler discussed progress on the TDRC-Ion Profile.

        1. Discussion of the distinction between treatment beams and setup beams. The difference in
260   radiation type for these beams has implications for meterset units. The RT Ion Treatment Record is intended to capture beam *meterset* only for *treatment* beams.

        2. There are many variations on beam setup workflow. Suggestion to focus the Profile on address the most common use cases. The main focus is on offline setup image review rather than dose accumulation.

265   3. The RT Ion Treatment Record can include references to reference images (per beam). The General Reference Module can be used to reference imaging Structured Reports.

        4. If it is desire to specify different levels of support for recording, additional Transactions will need to be defined.

        5. David Wikler and Bruce Rakes continue to work on TDRC-Ion. Input from others will be needed
270   to develop TDRC for photon-based therapy.

        6. A complete draft is expected in the next several meetings of the subgroup.

VI. Topic 5: ~~TPIC~~ (renamed to TRIC) / TDIC

    A. David Wikler discussed the status of TPIC and TDIC.

275   1. Identify Use Cases and reconcile TPIC and TDIC requirements.

        2. TPIC currently addresses planned patient position verification images and reference images.

            a. Current TPIC Use Cases (from Clinical Impact Statement)

                i   Generate reference images for patient positioning

                ii Annotation of reference to images facilitate acquisition of planned verification images
280   iii Ensure safe positioning and post-treatment review

            b. TDIC Use Cases (from Clinical Impact Statement)

                i   Transfer of reference images from TMS to TDD

        3. David used the IHE Workitem Proposal form to summarize the problem for TPIC and key use case for these Profiles.

285   a. Problem: incomplete or missing information in reference images used for patient positioning.

            b. Use Cases identified. Discussion of whether to limit scope to virtual simulation.

                i   Virtual Sim DRR reference images

                ii Conventional Sim DRR reference images

                iii Virtual Cim CT reference images
290   iv Simulator CT reference images

            c. Content requirements for reference images are the same for TPS → TMS and TMS → TDD transfers. For this reason, the Actors are designated Producer and Consumer.

            d. Discussion of Scope:

                i   RT Image DRR (reconstruction from any modality source, CT, pCT, or MR, for example) only
295   ii Suggestion to remove CT as no interoperability issue so far – decision to exclude it (can add in future versions)

            e. It was decided to change the name of the Profile to TRIC (Treatment Reference Image Content)

  f. Proposed Actors (other Actors can be added to support other modalities in the future)
    i Reference RT Image Producer
    ii Reference RT Image Consumer
    iii Proposed Transaction: "Transfer Reference Image". (Use "transfer" to avoid confusion of "storage" and "retrival"
  g. Concern was expressed about confusing terminology in Profile Actors. Similar Actors in different Profiles, e.g. "Archive" and "OST", have different names. Without clear rationale, these differences are confusing to new readers.
  h. David has shared his presentation with additional notes from discussion in the IHE-RO Box "All Files/IHERO TC share/Presentations" folder.
  i. ==ACTION 220203==: Jon Treffert to follow up with addition of explanatory text to Profiles in TF.
  j. ==ACTION 220204==: David Wikler to revise and update Use Case and Scope of TRIC and TDIC.
  k. Future Use Cases and Transactions
    i Treatment MR Images
    ii CBCT Dose Reconstruction
    iii Contours, Curves
    iv Re-planning
    v Dose Accumulation

VII. Topic 6: Participation of non-IHE members in informal workshop and Connectathons
 A. IHE-RO Planning Committee is eager to include all interested parties.
 B. A consensus of paying members is needed to address their concerns.
 C. Potential participants in XRTS and DRRO workshops that are not currently paying members include both academic groups, commercial start-ups, and non-paying commercial entities. The primary concern is with "free ride" commercial
 D. Costs/Benefits of participation in testing include
  1. Access to Test Tools
  2. Testing bandwidth
  3. Demonstration of Adhereence to Profiles
  4. Development of Test Procedures
  5. Publicity of IHE-RO testing
 E. Proposed Access Policy
  1. Formal testing categories were discussed:
   a. Commercial member – annual fee
   b. New member discount
   c. Academic member category / Non-profit category
  2. Workshops / informal testing
   a. ==**Workshop is open to IHE members, including those who do not pay for IHE-RO testing. However, only paying IHE-RO members have direct access to fully functional (unlimited) test tools. A time-limited version of the IHE-RO Content Validator will be prepared for distribution to non-paying participants.**==
  3. Test tools
   a. Time-limited version of test tools (supports subscription model)
   b. Cost of licensing mechanism to be assessed by AAPM (includes administrative expenses)
   c. ==ACTION 220205==: Demcon to incorporate DRRO Profile requirements in the IHE-RO Content Validator tool and release a (90-day) time-limited version in advance of the DRRO Workshop in April 2022.

VIII. Topic 3 (continued): AAPM Survey – new Use Cases?
 A. Jon Treffert continued review of the AAPM "2021 IHERO Survey combined v3.xlsx" with the TC. An annotated version of the Survey results (discussion notes in Column C) is to be shared in the IHE-RO Box folder.

IX. Topic 7: Next Meetings/Presentations/Deliverables
 A. Planning Presentation

1. TDW/DPDW February 15
2. TDIC March 15

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X. Adjourn – Session 2 was adjourned 2/15/22 at 1:00pm ET