

IHE-RO Technical Committee
Face-to-Face
September 20-21, 2021 9:00-13:00 EST
September 27-28, 2021 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	9/20	9/21	9/27	9/28
Chris Pauer	Sun Nuclear	chrispauer@sunnuclear.com	X	X	X	
Scott Hadley	U. Mich.	swhadley@umich.edu	X	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		
Richard Voegele	Brainlab	richard.voegele@brainlab.com	X	X	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	X
Thomas Schwere	Varian	Thomas.Schwere@varian.com	X	X	X	X
Naveen Kumar	Philips	naveen.kumar.lakshmana@philips.com	X		X	
Martin von Siebenthal	Varian	martin.vonsiebenthal@varian.com	X	X	X	X
Roland Waser	Varian	Roland.Waser@varian.com		X		
Rishabh Kapoor	VCU/VHA	Rishabh.kapoor@va.gov			X	
Michelle Casagni	Mitre	mcasagni@mitre.org	X			
Jeffery Lewis	Accuray	jlewis@accuray.com			X	
Francisco Nunez	Elekta	Francisco.nunez@elekta.com			X	
Cindy Cohen	Elekta	Cindy.cohen@elekta.com			X	
Tucker Meyers	Epic	tucker@epic.com			X	
Anthony DiDonato	Mitre	adidonato@mitre.org			X	

Minutes:

I. Meeting was called to order 9/20/21 at 9:05 am ET. A quorum was present.

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II. Meeting Scope

A. Review Agenda

B. Minutes from the July 19, 2021 TC teleconference were reviewed and approved with correction (“~~John~~ **Jon** Treffert”) without objection. (Motion: Harold, Second: David)

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III. Topic 1: Committee Updates

A. Planning and IHE

1. Scott Hadley is drafting a presentation for AAPM.

B. DICOM

1. Discussion deferred.

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C. Test Tools

1. Demcon is developing XRTS Validator.

IV. Topic 2: TDOR

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A. Thomas Schwere reviewed a draft of the TDOR Profile document (ihe_ro_tdor_0.4). No comments have been received so far.

1. Treatment Recording Process Flow has been revised by request of one or more TMS vendor(s). An “Update Treatment Record” Transaction has been added. The TDD now stores Treatment Delivery Results to the TMS *after* the UPS has been created.

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a. Discussion of the *scope* of Treatment Delivery Results: are (a) only those Treatment Delivery Results that were not previously stored to the OST or (b) all Treatment Delivery Results for the Treatment Session? Decision: TDD to send the remaining treatment records

b. When to check/cancel the UPS in case of an error? If the TDD creates an offline record UPS with erroneous Session UID (not managed by the TMS), the TMS may either (a) reject the UPS as invalid at creation or (b) cancel the UPS with an error after it has been created. Rejecting up front avoids storage of unnecessary instances. Later cancellation is more consistent

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2. For the TDOR Profile, the TDD is the UPS Creator and TMS is the UPS Performer. This arrangement differs from TDW-II.. The data to be reconciled are listed in the UPS Input Information Sequence.

a. There is a hidden dependency between TMS and OST. Issues include (a) readiness of OST to receive Treatment Delivery Results and (b) availability of results to the TMS.

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3. Open questions

a. Who schedules, who performs? Which Actor (TDD or TMS) should be the UPS Creator? the UPS Performer? Is this the purpose of the Profile to resume recording of an interrupted delivery record or to initiate reconciliation of delivery records for a session?

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i Initiating reconciliation from the TMS may be difficult as it requires reconstruction of the state before the incompletely recorded delivery.

b. What is the task to be performed? Is the procedure to be performed the offline *transfer* of records to the TMS or the offline *reconciliation* of records by the TMS?

c. In the model discussed, should the TMS perform a C-MOVE of Treatment Records from the TDD?

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d. In the model discussed, do we want to revisit the order of UPS Creation and Storage to OST?

e. Is it still acceptable to separate the TMS and OST Actors in the Profile?

V. Topic 3: TDW II – Final Text Review

A. David Wikler reviewed ihe_ro_supp_tdw-ii-vw-rev 20_20210802.docx

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B. Support of Multiple Targets Option (treatment of multiple targets defined in a single Treatment Plan). Requirements are expressed in the CDEB Profile (currently in Public Comment). Consensus that the

specification of RT Plan *content* is out of scope for the TDW-II Profile. All references to RT Plan content requirements are to be removed from the Profile.

- 85 C. Retain Original Treatment Records Option – Section 9.2.2 of the Profile was revised to indicate that all attributes from of all original treatment records of previous delivery of an interrupted fraction shall be retained by the OST. The TMS references the original treatment record allowing exact determination of how to continue the fraction.
1. OST stores RT (Ion) Beams Treatment Record instances as level 2 SCP without extended negotiation
 2. TMS references original Treatment Record instances in BDI Input Information Sequence for resumption. Also, the TMS may not modify the RT (Ion) Plan instance to be delivered.
- 90 D. In Section 3.61.4.1.3, add prohibition to use CONTINUATION if a new Treatment Plan is generated?

Discussion to be resumed 9/21/21at around 12pm ET.

95 [Adjourned for the day 9/20 at 1:07 pm ET]
[Meeting resumed 9/21 at 9:03 am ET]

VI. Topic 4 - How to connect a comprehensive Radiotherapy Solution into an existing Ecosystem (introduction of a new proposal)

- 100 A. Roland Waser (product manager, TMS at Varian) and Thomas Schwere gave a presentation on new TDS interface
1. Trends and Observations – more imaging, more complex treatments; tighter system integration motivated by safety concerns; push for faster adoption
 2. Varian Treatment Interface (VTI) – new access to TDS
 - 105 a. Technology (FHIR & DICOM); non-proprietary use case and data content
 - b. Published interface specification
 3. VTI
 - a. RT Solution = Integrated treatment delivery, planning, and management, e.g., ViewRay, Unity, Halcyon, ...
 - 110 i. External interface moves to a TMS/OIS level
 - ii. Actual interact to TDS is not exposed
 - b. OIS: ADT, Diagnosis, High-level Prescription, Appt. Scheduling, Tx monitoring (XRTS/FHIR)
 - c. RTS: detailed Rx, Tx plan, Plan review/approval, QA, session mgmt., Tx delivery, Tx monitoring/review
 - 115 4. FHIR
 - a. Modern RESTful protocol; excellent tooling; fast-growing community; RT use (XRTS); extensible
 - b. Clear separation of workflow and patient data
 - c. All RT specific data (patient model, plan, dose, records) remain in DICOM
 5. Why not DICOM Worklist?
 - 120 a. Aged protocol (limited availability, adoption of DICOM UPS-RS)
 - b. Limited adoption of DICOM Unified Worklist
 - c. Tendency towards FHIR for orders-based imaging workflow
 - d. In Worklist, both patient data and workflow data is packed into a single UPS object
 - e. FHIR resouces are simpler, more flexible
 - 125 6. Varian History
 - a. Work started HL7v2 (2016)
 - b. Introduced FHIR (2017) – first internal version
 - c. Re-assessment (2018) – market demands for access (e.g., RaySeach to TrueBeam)
 7. Direct access to TDS: extension to VTI
 - 130 a. TMS manages plans and treatment sessions
 - b. External system direct access to TDS, using FHIR transactions in place of UPS
 8. Next steps – discussion
 - a. FHIR, DICOM-web can simplify security implementations, single protocol stack
 - b. Adapted
 - 135 9. Questions for next week
 - a. Can this become the base of a new IHE-RO Profile? (some overlap with XRTS)
 - b. Overlap with TDW-II? Alternative? Replacement?

c. Does this approach support multi-system coordination for treatment delivery (DPDW)?

- 140 VII. Topic 7: TPPC Brachy
- A. Jim Percy reviewed rev. 20 of TPPC Brachy Profile (IHE_RO_TPPC_Brachy_v2.20.docx) with the group.
 - 1. Changes to US images (new Series) to include Frame of Reference Module are to be reflected in Manufacturer, Creation Date, Creation Time, etc.
 - 2. Changes to document have been accepted in rev. 20 (cf. rev. 19 for details).
 - 145 3. DECISION: The TPPC Brachy Profile rev. 20 was approved for Public Comment without objection.
 - 4. ACTION: 210901: Jon Treffert to forward TPPC Brachy Profile text to Mary Jungers for Public Comment.
- VIII. Topic 5: TDIC Review
- A. David Wikler discussed two versions of the TDIC Profile draft: vers. 1.1.1 and vers. 1.4 (from Thomas)
 - 150 B. The goal of the Profile is safe and unambiguous review of image registration and resulting position correction for a treatment session. TDIC is a Content Profile that deals with images and registrations acquired/created in the context of a treatment session. It may be possible to extend the Profile to accommodate patient positioning data.
 - C. Actors and Transactions
 - 155 1. Treatment Delivery Image Producer Actor optionally stores spatial registration
 - 2. Add Transaction [MMRO-III-1] to store Spatial Registrations
 - 3. Add Store Treatment Delivery Reference Images Transaction [RO-TDIC-2] to store DRR
 - D. Currently, the Profile has two Actors: Treatment Delivery Image Producer and Treatment Delivery Image Consumer. The content requirements depend on image type (DRR vs verification image) and modality. Discussion of whether to split these Actors by modality or use case.
 - 160 E. Use cases discussed
 - 1. Transfer of Treatment Images to Positioning Review
 - 2. Transfer of Treatment Images with Daily DRRs to Positioning Review
 - 3. Register Treatment Images Against Reference Image
 - 165 F. David will continue to
 - G. ACTION 210902: David Wikler to revise TPIC use cases for further discussion by the TC.
- IX. Topic 2: TDOR (continued)
- A. Thomas Schwere presented an revised TDOR Profile document
 - 170 B. A UPS is created in the TMS unconditionally.
 - C. The TMS responds with Failure to Set UPS In Progress Transaction if the requested Treatment Session UID is not recognized by the TMS. This allows the TMS to check that the Treatment Session UID is expected and prepare to receive Treatment Delivery Results before allowing UPS to proceed.
 - D. Consensus to proceed on development of TDOR using the workflow process shown by Thomas.
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- X. Topic 3: TDW II – Final Text Review (continued)
- A. Discussion of the source of patient header data (patient identification) for static Treatment Record instances in those implementations where the TDD maintains a local storage of the RT Plan/RT Ion Plan instances.
 - 180 B. ACTION 210903: David to rephrase this requirement in the context of consistency checks patient IDs in the UPS and local plans instances.
 - C. Should it be an explicit requirement to set the Procedure Step Progress to 100% if the UPS Procedure Step State is COMPLETED? Consensus to make this an explicit requirement.
 - D. Decision not to disallow a continuation UPS to deliver a plan of type CONTINUATION.
- 185 *[Adjourned for the day 9/21 at 1:00 pm ET]*
[Meeting resumed 9/27 at 9:02 am ET]
- XI. Topic 3: TDW-II review (continued)
- A. David Wikler reviewed a clean version (Rev. 1.2, Sep 27 2021) of the TDW-II Profile with the TC
 - 190 B. Clarifications after Connectathon 2021A (Closed Issues #21):
 - 1. Clarified progress updates requirements are linked to treatment delivery activities only
 - 2. Unified Reason for Discontinuation requirements with DICOM requirement

3. No additional constraint on values for N-SET response was necessary

4. Removed CDEB option as no requirements were set.

5. Clarified completed progress update requirement of 100%.

6. Editorial changes to comply with IHE Template rev 10.5.

C. Final text of the TDW-II Profile references the 2021d edition of the DICOM Standard.

D. For TDDs that maintain local instances of RT (Ion) Plan, the Patient Name, ID, Sex, DOB in the static objects (record and image) produced by the TDD may be derived from the local plans rather than the UPS.

1. This requires reconciliation by the TMS (based on UPS Output Information Sequence).

2. Some concern that more testing of discrepancies between UPS and local patient IDs is needed.

E. DECISION: The Technical Committee approved the updated text of TDW-II for Final Text.

F. ACTION 210904: Jon to forward the updated TDW-II to IHE (Mary Jungers) for publication.

XII. Topic 5: TDIC (continued)

A. David Wikler reviewed updates to the TDIC Profile draft.

1. Spatial registration Use Case reuses MMRO-III Transaction MMRO-III-1. Additional content requirements may be included for this use case.

2. Discussion of burned-in annotation in acquired images and DRRs. Sometimes used to identify pre- and post-correction DRRs. May be problematic for automated registration.

XIII. Topic 4: How to connect a comprehensive Radiotherapy Solution into an existing Ecosystem (continued discussion)

A. Adaptive planning/delivery: does this require a fully-integrated (closed) single-vendor "Radiotherapy Solution"?

B. Discussion of replacing UPS with FHIR for treatment delivery workflow.

1. Input from real-time adaptive (RAPTOR) consortium would be helpful.

2. Concern about the cost to vendors of investing in a new technology (FHIR). This is especially a concern for TDD vendors who do not interact directly with EHR/HIS systems using FHIR.

3. Use of FHIR for workflow management is still in early development. Instructions (e.g., BDI) would need to be created.

4. FHIR may be more easily extensible than DICOM UPS.

C. Proposed examination of use cases. What limitations in DICOM are better handled by FHIR?

D. Extend TDW-II for Adaptive Planning/Delivery with DICOM UPS or re-implement with FHIR?

1. Need to define Use Cases.

2. New (optional) Actors, e.g., Patient Position Acquisition System, may be needed.

3. Depending on adaptive use case, new Transactions for additional data will be needed.

XIV. Topic 8: Connectathon

A. 2021B Connectathon Timeline

1. Registration and participation agreement sent 9/3/21, due 10/1/21

2. Pre-test datasets loaded into Archive and Test Tool instructions distributed 10/8/21

3. Planning instructions for Connectathon distributed 10/15/21

4. Test Tool results due 10/22/21

5. Participant datasets loaded into Archive 10/22/21

6. Connectathon dates: Nov 8-10 (M-W) and 16-18 (Tu-Th), 2021

7. Wrap-up Meeting Nov 22, 2021 9am-12pm ET

B. Pre-testing

1. Data to be retrieved from DICOM Proxy Archive using VPN

2. Test datasets have been cleaned up to remove Content Validator errors

3. Please use the latest Content Validator and UPS Validator (available from Box share)

4. Alternative data for auto-segmentation based BRTO-II Contourer Actors (work in progress)

5. Potential revisions to BRTO-II content requirements for RT Structure Set. Allow ROIs without contours for auto-segmentation use case when no structure is present?

C. Connectathon Participation Straw Poll

1. BRTO-II

a. Contourer VA 3, RA 1, EL 1, BR 1

b. Dosimetric Planner. VA 1, RA 1, BR 1

c. Dose Displayer VA 2, RA 1, BR 1

250 2. MMRO-III

a. Registrator VA 2, RA 1, PH 1, EL 1

b. Registrated Contourer VA 2, RA 1, PH 1, EL 1

c. Registrated Displayer VA 2, RA 1, PH 1, EL 1

d. Registrated Dose Displayer. VA 2, RA 1, PH 1, EL 1

255 3. TPPC

a. Beam Producers VA 1, RA 1, BR 1

b. Beam Consumers. VA 1, RA 1

4. TDW-II – some thought that this Profile may not need to be tested for 2021B

a. TMS/OST VA, EL, RA

b. TDD. IB, ME, AC

260 5. TPPC-ION (informal)

a. Producers RA, VA, EL

b. Consumers. EL, VA, RA

265 6. ACTION 210905: Jon and Walter to follow-up with vendors regarding the need to test TDW-II.

D. Informal XRTS Testing

1. Environment

a. HAPI FHIR Server in Docker Desktop on IHE-RO Test Server

b. XRTS Validator on participant systems

270 2. Date – Dec 13-15, 2021

3. Demcon release anticipated around 10/8/21

4. Straw Poll

a. Treatment Observer VH

b. Treatment Summary Provider. VA, RA

c. Repository VA

275 5. Notification/Subscription for Updates (Optional Transaction)

6. Test Cases / Scenarios – Rishabh and Martin are creating test scenarios

XV. Updates

280 A. DICOM Update (Jim Percy)

1. Sup 160 has been approved for final text

B. AAPM 2022 Annual Meeting (Scott Hadley)

1. RFP for IHE-RO Session at AAPM 2022 Annual Meeting – Scott is taking the lead to prepare a proposal. Interest was expressed in several topics, including XRTS, TDW-II, interoperability testing, and support for adaptive therapy.

[Adjourned for the day 9/27 at 12:24 pm ET]

[Meeting resumed 9/28 at 9:03 am ET]

290 XVI. Topic 10: ROTH

A. Scott Hadley updated the TC on the status of the ROTH Profile. Use cases include continuity of care, clinical trial/registries, and data collection for quality assessment. Use cases may also include multi-patient data migration/archiving.

B. Data sources may include both TPS and OIS.

295 C. Dataset annotation/manifest describing roles/relationships among data objects is a key feature. An XML (FHIR-based) resource was discussed briefly.

D. ROTH is an extension of the RT Course concept. The data model may also include treatment site and treatment phase concepts.

E. The Data Archiving/Migration use case may help motivate vendor investment.

300 F. Proposal to create a ROTH subgroup to include Scott, Jim, Walter, Thomas. Other academic and vendor participants (TPS, TMS vendors) to be invited.

G. ACTION 210906: Scott to invite participants and arrange meeting of ROTH sub-group.

XVII. Topic 11: QRRO

- 305 A. ACTION 210907: Jon Treffert to follow up with Stefan Boman regarding the status of QRRO and next steps.

XVIII. Topic 6: TPIC

- 310 A. David Wikler discussed the latest version (rev 1.3) of the TPIC Profile document.
- B. Requirements for Frame of Reference, Isocenter, and Patient Position of reference image (RT Image) were reviewed and clarified. Details were captured in comments in the TPIC document. Summary below:
1. Transfer of information relating the imaging isocenter to the radiation treatment isocenter.
 2. Move X-Ray Image Receptor Translation (3002,000D) requirements from base to Planning (O+), Simulator (R+), and Treatment acquisition (R+) sections.
 3. Limit RT Image Plane (3002,000C) for DRR to NORMAL and allow NON_NORMAL for Simulator images. RT Image Orientation (3002,0010) shall have a value of 1\0\0\0\0-1\0 if RT Image Plane (3002,000C) is NORMAL. No imaging consumer appear to be able to import a NON_NORMAL RT Image and image acquisition machines represent the images in a NORMAL geometry.
 4. RT Image Position (Sx, Sy) where $S_x = -(C-1) * D_i / 2$ and $S_y = +(R-1) * D_j / 2$; C = columns, R = rows, D_i = column spacing, D_j = row spacing
 5. RT Image SID shall be equal to SAD for a DRR. Move from base to Planning.
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- 325 C. ACTION 210908: David to revise TPIC Profile as (rev 1.4) per discussions. (Profile to be reviewed by TC).
- D. Testing of TPIC
1. No plan for formal testing of TPIC at the 2021B Connectathon.
 2. Test tools require some (minor) updates, but could be used for informal testing.

330 XIX. Testing and Test Data

- A. Availability of data for test tool development and preparation for Connectathon testing.
- B. Members have access to the Connectathon Archive and can use Test Tools to retrieve and check adherent datasets.
- 335 C. Vendors were encouraged to share data via Box. This has been quite effective in advancing development of interoperable applications in the DRRO subgroup.

XX. Topic 12: Profile Inventory/Status and 2021/2022 Priorities

- A. Review 2021/2022 Goals (details captured in *Profile_info_2021-2022.xlsx*)
1. TDW-II: technical framework
 - 340 2. TDOR: public comment → trial implementation, assess test tool effort
 3. XRTS: public comment, test tools, informal testing
 4. TDIC: new round of public comment, informal testing
 5. TPIC: new round of public comment, informal testing
 6. Offline Review: examine non-ionizing modalities, workflow requirements
 - 345 7. HDSS (High Definition Structure Set): draft (RV to confer with Christof on scope) – subgroup?
 8. TPPC-Brachy: JP to followup with DICOM subgroup
 9. TDRC-Brachy: progress on draft
 10. ROTH: assemble subgroup
 11. DRRO: trial implementation, informal testing
 - 350 12. FDII: identify champion, follow up with DICOM WG
 13. QRRO: follow up with Stefan
 14. TPPC-Ion: trial implementation
 15. TDRC-Ion: trial implementation
- B. Additional goals from Planning Committee survey

XXI. Meeting adjourned 9/28/21 at 12:49pm