



## Guide to Audio Recording P4XT Digital Multiplexing Transponder Workshop

Sunday 9 February 2020 (3PM – 7PM)

The DMT workshop was held at Starter Studio's Conference room in downtown Orlando, 4.5 miles from the HamCation venue. A full audio recording (330MB MP3) is available at [https://www.dropbox.com/s/9k065i5kqj3i49w/200209\\_1316.mp3?dl=0](https://www.dropbox.com/s/9k065i5kqj3i49w/200209_1316.mp3?dl=0). This document is a guide to navigating the recording.

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|-------------------------|-----------------------|----------------------------|
| Wally Ritchie WU1Y      | Jan Tarsala WB6VRN    | Paul Davis KK4RAW (remote) |
| Paul Williamson KB5MU   | Scotty Cowling WA2DFI | Thomas Parry (remote)      |
| Michelle Thompson W5NYV | Dan Babcock           |                            |
| Phil Karn KA9Q          | Randall Berger        |                            |

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| 00:00:00 | Pre-meeting chat, joined in progress; toward better voice codecs          |
| 00:07:38 | Fitting voice into the system; uplink and downlink channel allocation     |
| 00:17:58 | Putting students to work on the project                                   |
| 00:22:36 | Wally describes the shape, scope, and status of a "real" DMT project      |
| 00:35:55 | FPGA development considerations (FPGA in the cloud)                       |
| 00:40:22 | Need for verification and validation in a real project                    |
| 00:43:22 | Use of commercial ASICs in ground station receiver                        |
| 00:52:40 | Are we nuts? How big is this project?                                     |
| 00:56:32 | How does this fit into university programs?                               |
| 01:01:46 | Overlap with AREx Lunar Gateway project with ARISS, JAMSAT                |
| 01:03:42 | The radio stuff (and antenna stuff)                                       |
| 01:09:28 | FPGA codebase for multiplexed DVB-S2/X transmit could be done soon        |
| 01:12:40 | Maybe do the transmitter side in an ARM CPU, and why not                  |
| 01:15:18 | NDA restrictions on commercial ASICs, and EOL concerns                    |
| 01:25:38 | Phil asks about project milestones  |
| 01:26:58 | Phil proposes a downlink prototype for a high altitude balloon            |
| 01:30:07 | Phil says he is "speaking as a potential funder", ARDC                    |
| 01:36:40 | Phil admits that the balloon idea might not be the best                   |
| 01:41:38 | Phil advances a theory of motivation through dopamine milestones          |
| 01:43:02 | Prototyping strategy; no such thing as breadboards anymore                |
| 01:48:13 | How prototype milestones interact with engineering volunteers             |
| 01:51:52 | How many milestones? In a planned order? Opportunistic management         |
| 01:56:35 | The list of deliverables. Phil says he didn't see it. Already published.  |
| 01:58:10 | Scotty cares about hardware, not simulations. Incremental designs.        |
| 02:03:30 | Goal for hardware prototype transmitter is in the proposal.               |
| 02:03:50 | Helping Phil find the proposal on the ORI web site                        |
| 02:05:23 | Validating the design against existing commercial equipment               |
| 02:06:40 | Wally, Scotty, Phil: must validate chips and wires on a board. That's \$. |
| 02:12:55 | Jan: not just boards, validate the whole microphone-to-speaker system     |
| 02:14:30 | Michelle describes the CubeQuest Challenge experience                     |

02:15:52 Scotty: that's it, little board designs that prove an incremental step.  
02:16:02 Michelle: that's what we do.  
02:16:18 Phil: That's something I think we could support. Bite-sized pieces.  
02:16:36 Wally: multi-channel receiver, and all the "easy" stuff in a blob.  
02:16:55 Decomposing blobs of hardware into verifiable increments.  
02:18:34 Consensus emerges: validate everything!  
02:20:55 Jan: exiting the meeting. Watch the launch(es).  
02:26:20 Abort on countdown! Distracted by the launch coverage.

02:34:00 Break

02:57:17 Funding and Structure  
02:57:39 Everybody is on the same page on engineering, complexity  
02:58:12 Wally: whole project is not much more than \$500,000 (not space)  
02:58:55 Phase 1 feasibility demonstration, ~\$50,000 program. 1-2 page doc.  
02:59:27 Success in Phase 1 would lead to funding the whole program.  
02:59:40 Phil: agrees, "that I can support"  
03:00:13 Dealing with the open source requirement and NDA info  
03:04:02 Phil: this would be a test case as a piece of "commissioned engineering"  
03:04:53 Wally: we are at the mercy of FPGA vendor IP blocks  
03:05:36 Scotty: we won't use Open Cores IP in place of vendor IP (discussion)  
03:06:12 Does that imply that you need to buy vendor licenses to modify it?  
03:09:18 Phil: John Gilmore is religious about open source. He might object.  
03:11:07 Phil: Bdale Garbee has experience with these issues, maybe solutions.  
03:12:48 Michelle: OSI and Ben Hilburn are working a FPGA license definition  
03:15:33 Wally: Phase 1 \$50k. Phase 2 ~\$500k. Deployment to space, ~\$5M.  
03:15:45 Phil: \$5M is pretty big, even for ARDC.  
03:15:58 Global partners likely for deployment  
03:16:11 Phil: basic philosophy of ARDC, fund risky small projects, expect failures.  
03:17:48 Wally: begin to wrap up the meeting  
03:18:13 Wally: we are close to a world-class team (Phil agrees)  
03:18:41 Michelle: we're doing well on diversity  
03:18:48 Big educational wins, too  
03:19:20 Mentoring will be big  
03:19:34 Should be lots of journal papers, presentations, etc. Already have been!  
03:20:40 Thesis projects?  
03:23:03 ESA might be able to provide "lab time" for testing  
03:23:40 Phil's observations on Friedrichshafen ham radio conference and QO-100.  
03:29:58 Wally: wrapping up the meeting  
03:30:12 Wally: need to educate the community on DVB-S2 more  
03:31:07 Phil: in Europe they might ask about uplink jammers  
03:31:16 Michelle: we have a paper on authentication and authorization, etc.  
03:31:54 Paul: feedback from Jonathan Naylor that we prevent experimentation  
03:32:21 Alternatives to linear transponder for waveform experimentation  
03:38:42 Could try some of these ideas on Rent-A-Geo (or QO-100)  
03:43:35 Post-meeting chit-chat  
03:49:03 Recording ends