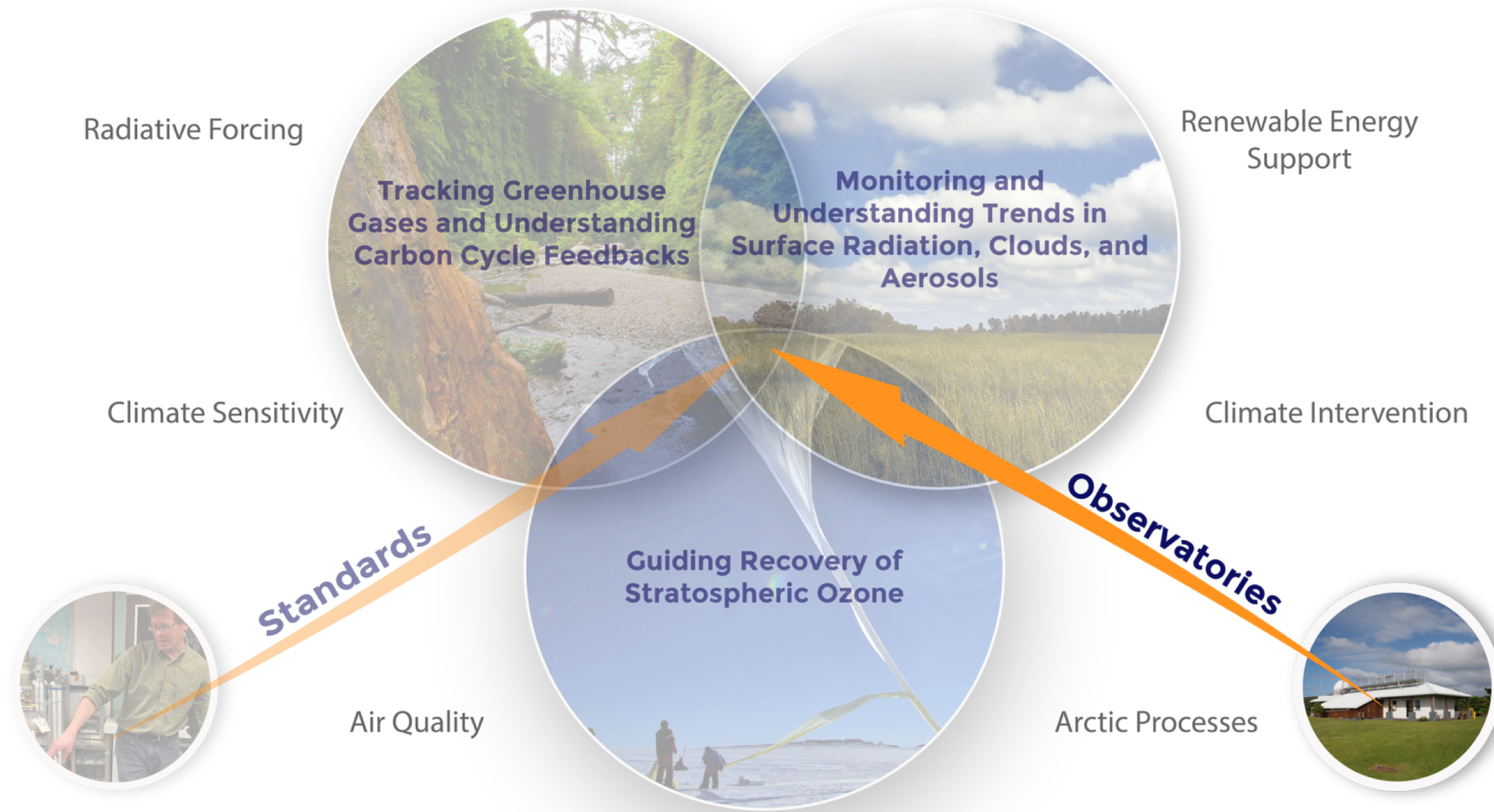


Atmospheric Baseline Observatories



Brian Vasel
Director of Observatory Operations

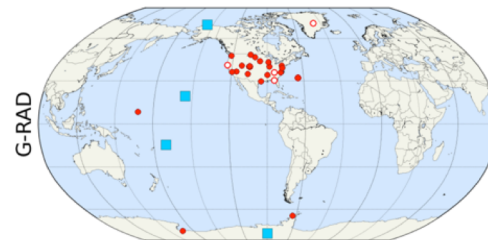
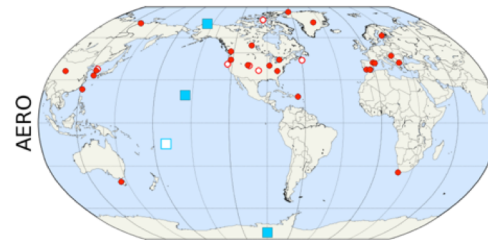
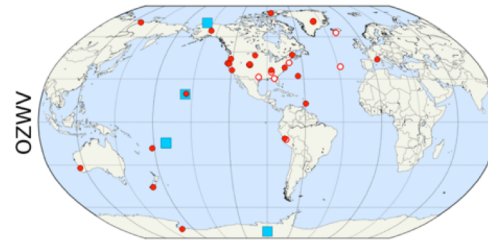
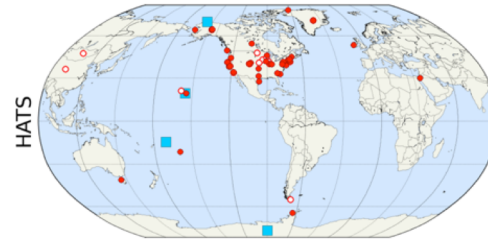
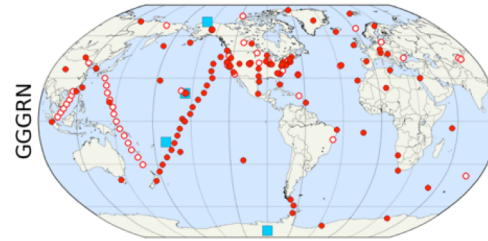
Backbone of Global Networks



Barrow (BRW)
Elevation: 11m 71.3° N Latitude



American Samoa (SMO)
Elevation: 42m 14.2° S Latitude



Mauna Loa (MLO)
Elevation: 3397m 19.5° N Latitude



South Pole (SPO)
Elevation: 2840m 90° S Latitude

Observatory Operations Philosophy

ABOs enable and support Science → Science drives decisions

- **Stewardship** – Build upon foundation of high-quality observations for over 45 years, continue “national treasure” legacy
- **Customer Service** – Plug and play remote field operations for researchers
- **Resources Tool Kit** – Provide highly skilled workforce & core of supporting measurements (meta-data) at each observatory. Updated meteorology, web cams, all-sky imagery, ceilometers, etc.
- **Efficiency** – Thrifty and resourceful operations; every dollar for operations is a dollar less for science
- **Innovation** – Expand and enhance the use of renewable technology, modernize instrumentation
- **Platform for Growth** – Dependable observatory resources + co-location of measurements = increase in interagency & interdisciplinary science collaboration
 - Promotion of observatory platform to audiences external to GMD
(Other NOAA line offices, Federal partners, & University PIs)



ABO Historical and Relational Significance

Staff Collaboration

- Federal
- CIRES & JIMAR (Cooperative Institutes)
- STC contractors
- NOAA Corps Officers
 - 2-3 officers assigned to GMD at any given time

Longevity

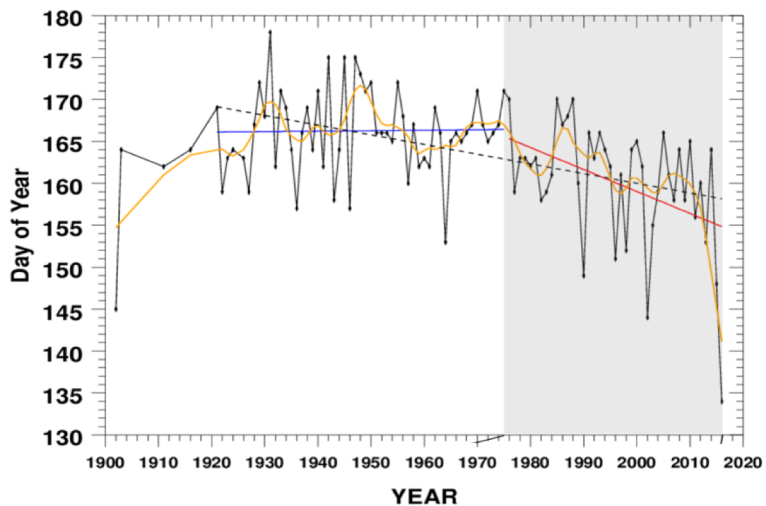
- MLO and SPO records date back to 1956 and 1957 (IGY)
- BRW records begin in 1973, SMO in 1974
- First Geophysical Monitoring for Climatic Change (GMCC) Summary Report (1972)
 - "... data are collected by a few observatories whose location ...chosen to sample representative latitudes within both hemispheres ...where local man-made or biota interferences are minimal'.*
 - First priority is placed on the collection of impeccable measurements of trace constituents."***
- WMO Global Atmospheric Watch (GAW) network modeled on ABOs



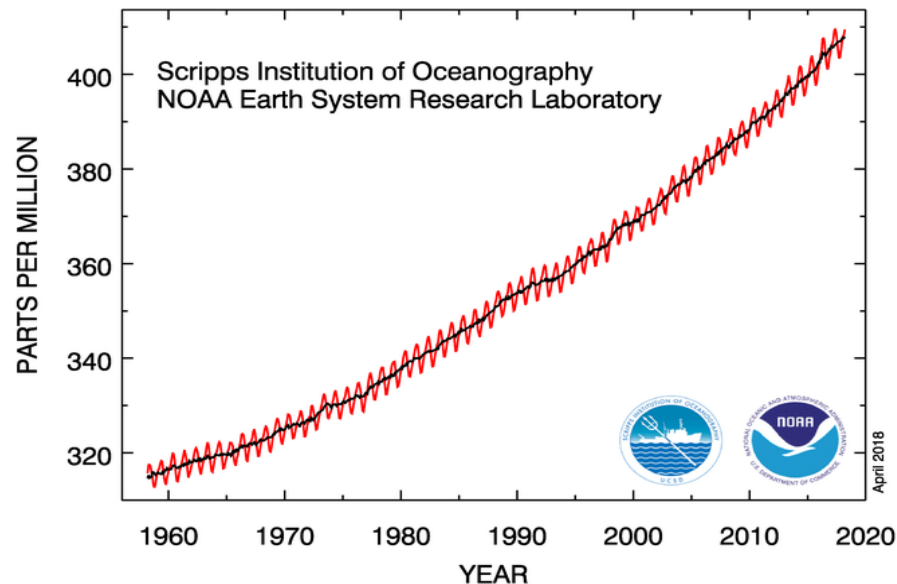
© MLO Archive
Mauna Loa Dedication June 28, 1956

ABOs - Home of Scientifically Renowned Records

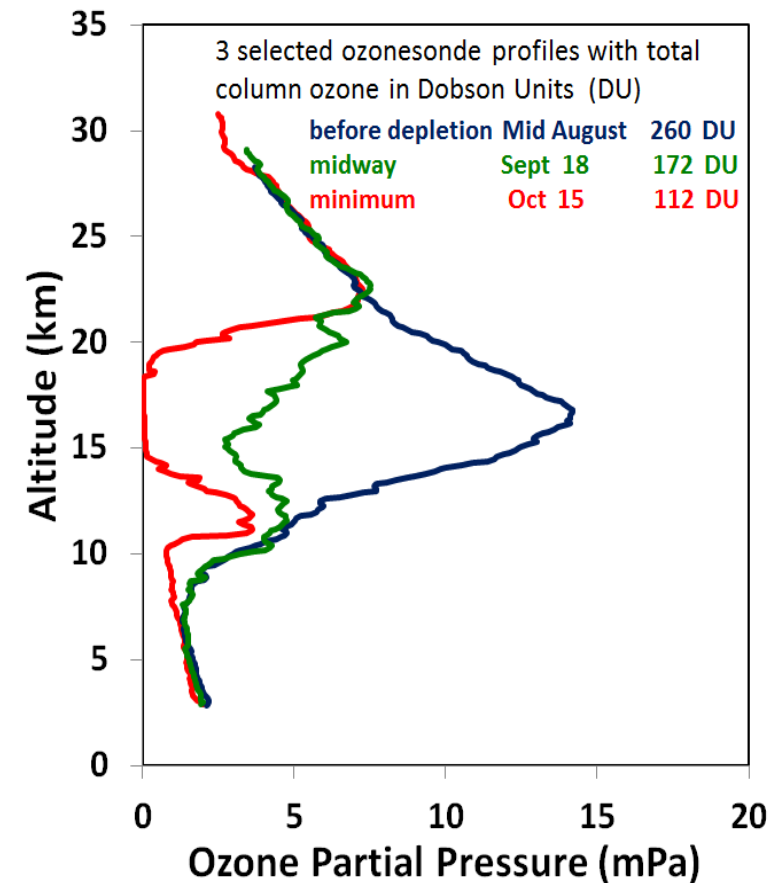
Barrow Snow Melt Date



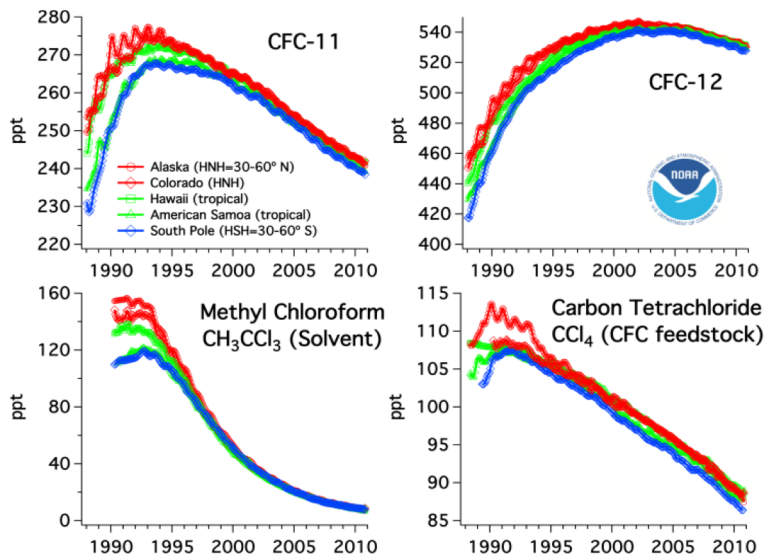
Atmospheric CO₂ at Mauna Loa Observatory



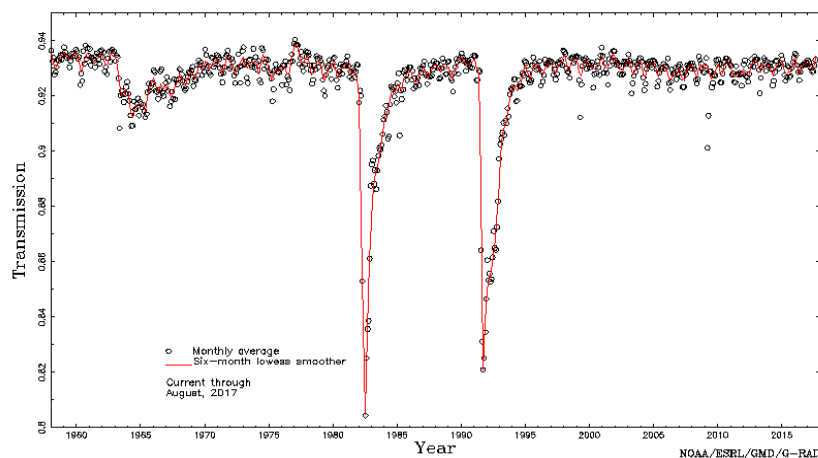
South Pole Ozone Hole



Ozone Depleting Gases



Mauna Loa Apparent Transmission



ABO Stats

- Total Peer-reviewed Publications using ABO datasets: 6,307
- **2251 Peer-reviewed Publications Since 2013 Review!**
- GMD Data Sets: 775
- Staff: 16
- Vehicle Fleet: 7
- Total Acreage: 135
- Miles of Driveway: 19
- Cooperative Research Projects: 70
- Solar Power: 165 panels (SMO = 33% and MLO = 20% of daytime demand)
- Total Structures: 67



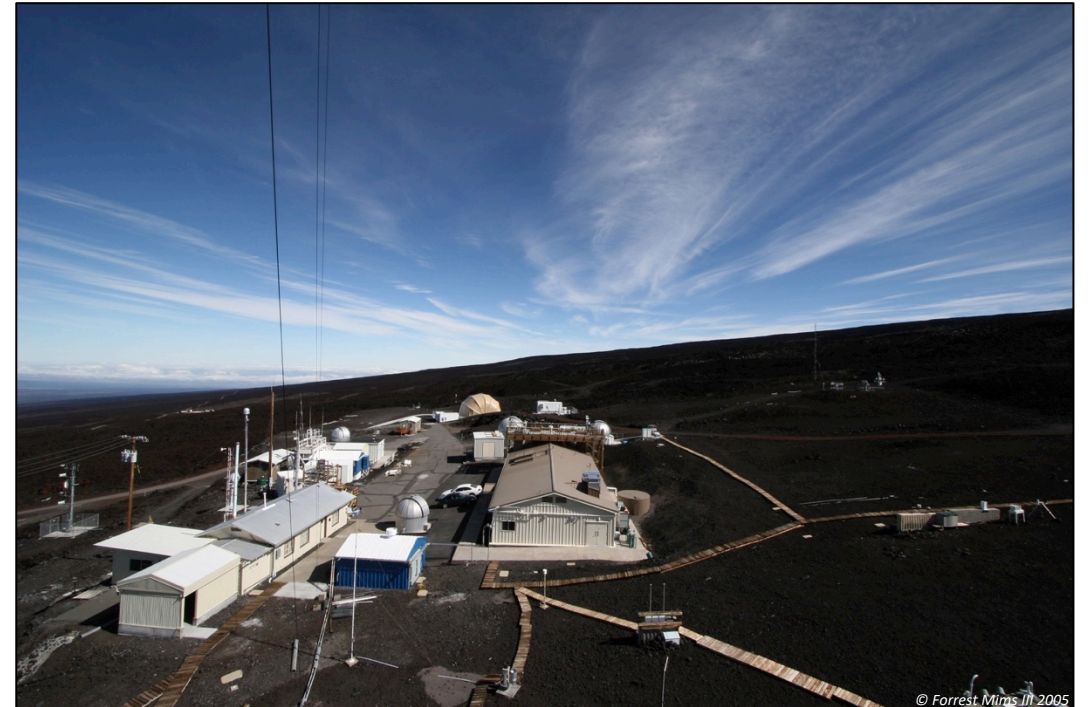
© Robert Schwarz 2017

Ozonesonde balloon time-lapse at SPO

Operational Challenges

Operating Field Sites in remote locations poses unique challenges...

- Tight procurement & shipping timelines
- Dirty power
- Cultural considerations
- Natural disasters
- Extreme climates
- Clean Air Sector management
- NEPA & State Historic Preservation Office (SHPO) requirements
- Training of observatory personnel to provide reliable science support workforce
- Infrastructure maintenance



© Forrest Mirra III 2005
Mauna Loa Observatory from tower

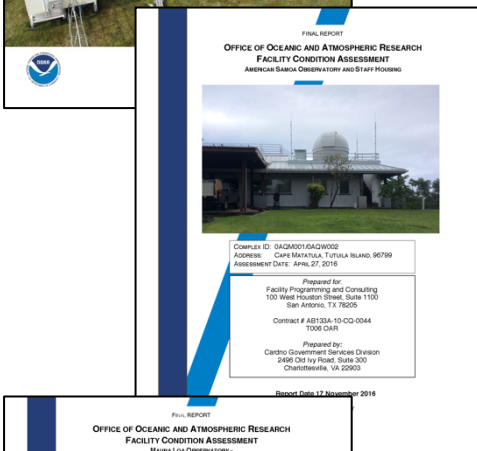
Facility Deferred Maintenance

Facility Condition Assessments (FCAs) – NOAA OCAO effort across agency



BRW – April 2015

- *“...the Observatory is in poor condition and appears to have outlived its useful life.”* Executive Summary, Page 10



SMO – April 2017

- *“... the Observatory Site is in Poor condition and is rated as a D... condition is still somewhat adequate, but the assets are headed toward the latter half of their lifecycle.”* Executive Summary, Page 4



MLO – June 2017

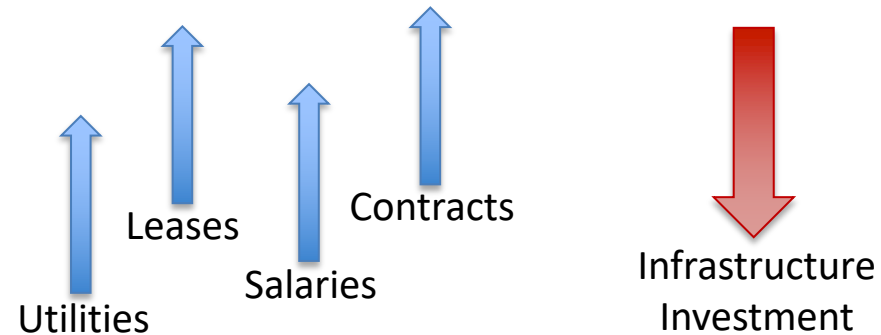
- *“... the Observatory is in working order, however, OAR should plan for upcoming capital costs related to component renewals.”* Executive Summary, Page 7

Total = \$1.8M in deferred maintenance projects

Keeping the Lights On

Simple Math

- Inflation: Increasing Cost of Business
- Steady Science Mission
- Flat Observatory Budget
- Increasingly Difficult to Manage



Prioritized Investments

- Life/facility safety
- Failures/repairs
- Improvements

Critical Mass

- Infrastructure investment essential to service science & maintain quality
- Science suffers without dependable resources



**Cyclone Gita Damage at SMO
February 2018**

Considerations for THD & SUM

Hard Decisions

No longer support Trinidad Head, CA (THD) or Summit, Greenland (SUM) as NOAA “Atmospheric Baseline Observatories”. However, still have critical measurements at each site.

- Rationale for sites & impact to partners
- Current facilities & planned upgrades
- Local influences vs. background? Science requirements...
- Efficiency – logistics requirements for each project:
 - Removed cargo/staff intensive projects
 - Kept low maintenance/power projects

- Ongoing Measurements:

THD

Aircraft flasks
HATS flasks
Ozonesondes
Surface ozone

SUM

CCGG flasks
HATS flasks
Aerosol suite
Meteorology



Trinidad Head, CA

New York ANG LC-130 at SUM



Cooperative Research Projects

- Currently ~70 projects across the observatory network are supported



1. Management process redesigned for cooperative projects to leverage Google platform benefits:
 - Email, calendar, forms, drive storage, and secure sharing to field sites

2. New & improved external support webpage created to enhance information sharing with partners, to include:
 - New request/renewal process
 - Logistics
 - Site access,
 - Fee structure, etc.

- ***We currently bring in \$250K in reimbursable funds from partners***

Near Term Observatory Goals

Efficiency – Greening the Observatories:

- Renewable energy
- LED Lighting 2018 DOC Green Grant

Building on Partnerships:

- Hilo office (NWS)
- USCG flight/cargo support
- NSF Office of Polar Programs (Arctic & Antarctic)
- Cooperative Projects
- Australia BOM/CSIRO staff training & exchange

Investment in Science:

- New Barrow Observatory Main Building
- New ARO at South Pole
- Additional land buffer at Mauna Loa
- NOTAMs for CAS no-fly zones
- Increase project cost reimbursements



Solar Panels installed at MLO



Observatory Take Away

- **Unique to OAR and NOAA**
- **Effective Spending**
- **Collaboration**
- **Innovation and Evolution**
- **Maintenance of Global Leadership**
- **Expand relevance to meet societal need**



World-class science demands world-class facilities

Our Bi-Polar Observatory Team Thanks You!

March 21st, 2018



Sunrise at the Barrow Atmospheric Baseline Observatory – Vernal Equinox



Sunset at the South Pole Atmospheric Baseline Observatory – Autumnal Equinox

Questions?



© Patrick Culles 2009

The Night Sky over South Pole Station

Observatory Relevant GMAC Presentations:

- Oral Session 3 – Morris
- Oral Session 3 – Cox
- Oral Session 4 – Johnson
- Oral Session 4 – Petropavlovskikh
- Oral Session 4 – Witte
- Oral Session 8 – Davis
- Poster 2 – Williams
- Poster 3 – Ivey
- Poster 35 – He
- Poster 43 – Barnes
- Poster 44 – Shiobara
- Poster 48 – Disterhoft
- Poster 54 – Sun
- Poster 70 – Dix
- Poster 71 – Koenig
- Poster 74 – McClure-Begley
- + 14 additional