XMM-Newton Science Support,
Working together in support of the scientific community

Maria Santos-Lleo
With acknowledgement to the whole XMM-Newton Science Operations Centre at ESAC
In this talk

- Introduction to XMM-Newton
- A personal view of the evolution and achievements of the Scientific Support since launch in Dec 1999
Unveiling the hot and extreme conditions at the Universe
The Observatory: telescopes and instruments in space

Spacecraft (the dome) & Payload (telescopes and instruments)

- Launched: Dec 1999
- Orbit: 48 h period

16 m
3.8 tons
10 m
3.8 tons

Sci Ops 2013 | M.Santos-Lleo | XMM-Newton, ESAC | 12 Sep 2013 | Pag. 4
The instruments

Two X-ray MOS cameras

1 X-ray pn camera

X-ray spectrograph, RGS

Optical Monitor, OM
The science data
Science Support: activities

**Observatory-type mission:** support astronomers from proposal preparation to scientific publication

- Run the annual call for proposals, provide relation with scientific community
- Provide scientific planning: long & short term plan, ToO
- Monitor Instruments
- Deliver instrument calibration
- Deliver tools for data analysis
- Deliver raw and processed data
- Provide a scientific archive
- Provide generic community support: documents, web, helpdesk, workshops
Science Support: activities

Observatory-type mission: support astronomers from proposal preparation to scientific publication

- Working together:
  - Run the annual call for proposals, provide relation: with scientific community & Time Allocation panels
  - Provide scientific planning: long & short term plan, ToO
  - Monitor Instruments: with Instrument PI teams
  - Deliver instrument calibration: with Instrument PI teams
  - Deliver tools for data analysis: with Science Survey Centre (SSC)
  - Deliver raw and processed data: with SSC (discontinued in 2012)
  - Provide a scientific archive: with ESA Science Archives Team
  - Provides generic community support: documents, web, helpdesk, workshops
Observatory-type mission: support astronomers from proposal preparation to scientific publication

- Working together:
  - Run the annual call for proposals, provide relation: with scientific community & Time Allocation panels
  - Provide scientific planning: long & short term plan, ToO
  - Monitor Instruments: with Instrument PI teams
  - Deliver instrument calibration: with Instrument PI teams
  - Deliver tools for data analysis: with Science Survey Centre (SSC)
  - Deliver raw and processed data: with SSC (discontinued in 2012)
  - Provide a scientific archive: with ESA Science Archives Team
  - Provides generic community support: documents, web, helpdesk, workshops
Science Support: objective

Observatory-type mission: support astronomers from proposal preparation to scientific publication

- Working together:
  - Run the annual call for proposals, provide relation: with scientific community to get the best science out of XMM-Newton
  - Provide scientific planning: long & short term plan, ToO
  - Monitor Instruments: with Instrument PI teams
  - Deliver instrument calibration: with Instrument PI teams
  - Deliver tools for data analysis: with Science Survey Centre (SSC)
  - Deliver raw and processed data: with SSC (discontinued in 2012)
  - Provide a scientific archive: with ESA Science Archives Team
  - Provides generic community support: documents, web, helpdesk, workshops
Science Support: evolution of resources

Observatory-type mission: support astronomers from proposal preparation to scientific publication

➢ Working together:

➢ Run the annual call for proposals, provide relation: with scientific community: nearly constant in number, new people

➢ Provide scientific planning: long & short term plan, ToO

➢ Monitor Instruments: with Instrument PI teams

➢ Deliver instrument calibration: with Instrument PI teams

➢ Deliver tools for data analysis: with Science Survey Centre (SSC)

➢ Deliver raw and processed data: with SSC (discontinued in 2012)

➢ Provide a scientific archive: with ESA Science Archives Team

➢ Provides generic community support: documents, web, helpdesk, workshops: Science Ops Centre
Science Support: evolution of tasks

Observatory-type mission: support astronomers from proposal preparation to scientific publication

- Working together:
  - Run the annual call for proposals, provide relation: with scientific community & Time Allocation panels
  - Provide scientific planning: long & short term plan, ToO
  - Monitor Instruments: with Instrument PI teams
  - Deliver instrument calibration: with Instrument PI teams
  - Deliver tools for data analysis: with Science Survey Centre (SSC)
  - Deliver raw and processed data:
  - Provide a scientific archive: with ESA Science Archives Team
  - Provides generic community support: documents, web, helpdesk, workshops
Science Support: evolution of tasks

- **Proposal cycle:**
  - New proposal types
  - New astronomers, Ph D
  - New tools
  - More sophisticated ideas

- **Mission planning:**
  - Increase efficiency
  - Fixed-time/coord observations

- **Instruments:**
  - New modes
  - Improve on calibration
  - Contingencies, time evolution, cross-cal with other missions

- **Data analysis software:**
  - New tasks
  - New H/W platforms

- **Pipeline data processing:**
  - Optimized algorithms
  - New science products

- **Archive:**
  - Need to adapt to new technologies: e.g. full re-engineering

- **Fixed tasks:**
  - Check & optimize proposals
  - Mission planning
  - Conferences ...
How to manage?

- Budget pressure (with time) but constant load

- Key
  - Team
    - core team with great expertise from previous missions and/or high scientific background (mainly in X-ray astronomy, but not only)
    - new people with a lot of enthusiasm and new ideas
    - Different internal teams co-located and interacting
  - Tools developed in the team or adapted from previous missions
  - Keep inst. modes simple, while adapt to evolution and scientific community needs
  - Smooth interaction with inst. experts, coordinated by ESA cal. scientist
  - Smooth interaction with external S/W developers and taking over of their tasks as they leave, if internal resources allow it
  - Keep interaction with community as highest priority: keep high level of support
Tools

- Mission Planning, ToO (very high rate), proposal technical evaluation tools: xrtops (adapted and significantly enhanced version of early rtops)
- OTAC support tool
- Conference organization tools
Calibration, Data analysis, processing and archive

- Cross-calibration with X-ray instruments of other missions
- Software analysis system (SAS): new releases per year, with changing platforms
- Data processing pipeline, transferred and running
- New archive: requirements prepared as per community needs
Community Support

- Helpdesk
- Check every proposal & contact PI for science optimization
- Documentation, manuals, reports
- Web
- Image Gallery
- SAS (data analysis) workshops
Community Support

Science
Conferences
& workshops,
The X-ray Universe 2014
16-19 June, Dublin

Get input via Project
Scientist and Users
Group

→ Keep contact with community
+ 13 years of operations: XMM-Newton remains one of the ESA flagship missions, ranked very high by advisory committees, keeps interest by scientific community and high productivity indicators:

- **Oversubscription** factor in AO12 (October 2012) was 5.9 in time

- **Number of scientific papers** in refereed journals making direct use of XMM-Newton data remains constant at rate of ~300/yr

- **Number of astronomers**: proposal PI+CoI, S/W and archive users remains at about 1500, with new people coming in (and going out). Conference attendance over 300 people.