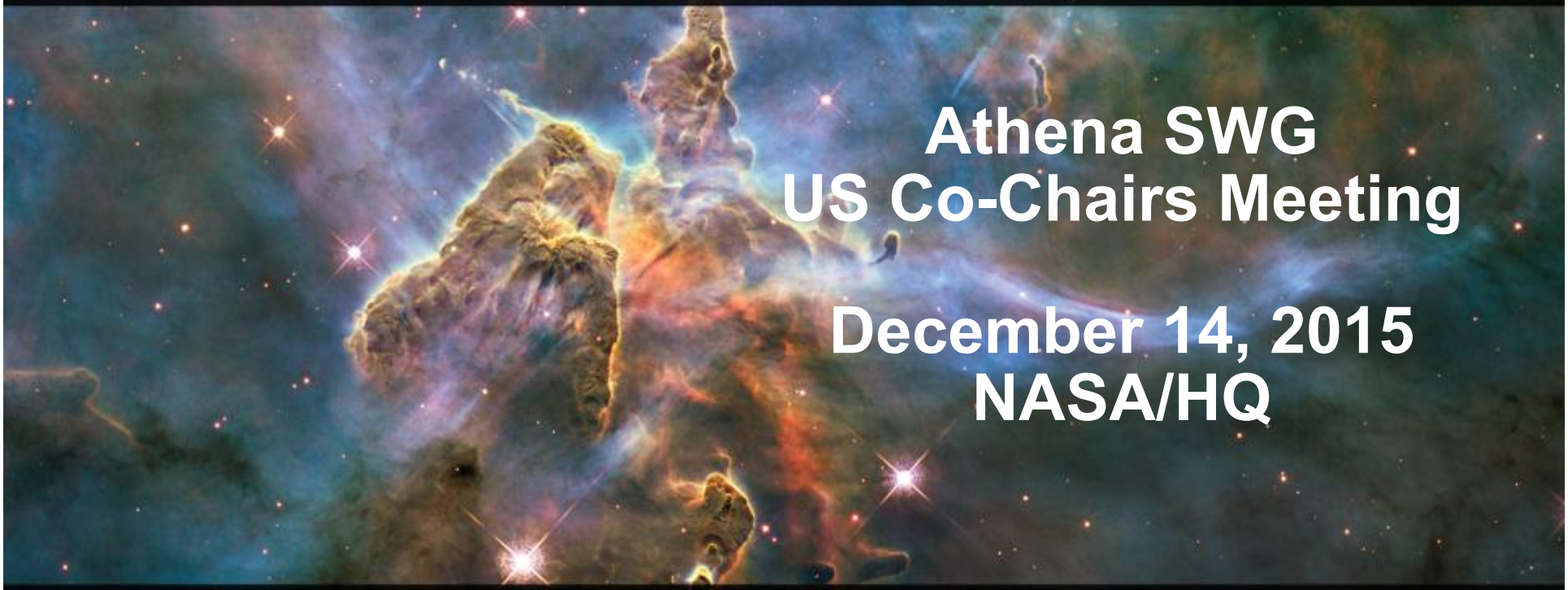
National Aeronautics and Space Administration



Athena SWG
US Co-Chairs Meeting

December 14, 2015
NASA/HQ

Astrophysics

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Athena SWG US Co-Chairs

- Introductions
- Purpose of meeting
- Future Schedule/group?

Decadal Recommendation

- Decadal Survey (New Worlds, New Horizons in Astronomy and Astrophysics; 2010)

"If IXO is selected for the first L-class launch, NASA should request that a decadal survey implementation advisory committee review the IXO case and examine progress in the mission design and readiness. If the review is favorable, NASA should be prepared to invest immediately in technology development at a high level, and work with the project to define the partnership agreements (p 214). [There are] significant technology development needs for IXO, primary among them being the selection and demonstration of the critical X-ray optics (p 155)."

ESA Selections

- 2012: ESA does not select IXO for the L1 opportunity as the first large mission in the Cosmic Vision Programme.
- 2014: ESA selects Athena mission for the L2 opportunity as the 2nd large mission in the Cosmic Vision Programme, launching in 2028.
- Language from ESA 'Call for Missions':

2.3 International cooperation

Large missions are **European-led missions, which are however open to international participation in the form of contributions from international partners**. In principle any mission element (i.e. payload, spacecraft, launch, operations, etc.) is open to "international participation", i.e. to provision of such element from partner agencies from non-ESA member states. Any contribution from international partners will have to have a potential replacement that is based on European technology, and their total envelope will **be limited to approximately 20% of** the total mission envelope.

Proposers are welcome to suggest possible schemes for international participation, bearing in mind that the actual scheme for mission implementation will be the outcome of the phase A study activities, and will depend on direct negotiations between ESA and the partner agencies. **At the present time both NASA and JAXA/ISAS have expressed a clear wish to participate to the phase A study activities in view of defining their potential participation to the mission implementation.** For this purpose ESA plans to include US and

NASA Collaboration with ESA

- US Participation:
  - US representation on Athena Science Study Team and community-based Athena Science Working Groups.
  - NASA appointed a US scientist (Randall; Rob & Mike ex-officio) to the Athena Science Study Team and US scientists (80+) to the Athena Science Working Groups.
  - 2014: NASA issued RFI to assess interest by U.S. organizations in providing hardware for the Athena mission.
- Formulation of the mission by ESA is underway, and a strawman design mission was completed in 2014. ESA plans an instrument AO in Summer 2016, selection soon thereafter.

US Athena SST Membership

- Several dozen applications
- Applications of very high quality, senior/leaders of community well represented
- Committee formed to review applications
- Randall Smith recommended
- NASA nomination with ESA appointment

Physics of the Cosmos Program Analysis Group (PhysPAG)

Call for U.S. Scientists to serve on the ATHENA Science Study Team

Dear Colleague,

NASA is now soliciting applications and nominations for individuals affiliated with U.S. institutions to participate in the ESA Science Study Team for The "Advanced Telescope for High-ENergy Astrophysics" (ATHENA).

Background: In November 2013, ESA selected the "Hot and Energetic Universe" as the theme of the second large mission (L2) in its Cosmic Vision program. The theme is to be addressed by an X-ray Observatory led by ESA, to be launched in 2028. On June 27, **ESA announced that the Advanced Telescope for High Energy Astrophysics, ATHENA, is the mission concept to fulfill this theme**. ESA will assemble a Science Study Team (SST) to initiate the required study activities during the Assessment Phase of the ATHENA concept.

NASA will be working with ESA to define the possible NASA contribution to this ESA-led X-ray mission. ESA anticipates appointing a NASA-nominated and ESA-selected scientist affiliated with a U.S. institution to be a member of the ATHENA SST.

Nomination Letters: Applications and nominations to serve as NASA-nominated member of the SST should consist of a cover letter including a statement of expertise pertinent to serving on the SST, a one-page Curriculum Vitae including publications, and a statement of availability and commitment to serve on the ATHENA SST during its ~2 year lifetime. Applications and nominations will be accepted for candidates affiliated with U.S. institutions.

Applications are due Monday, July 7, 2014 at 5 pm local time. Only email applications of a single PDF file will be accepted. Please submit your application via email to Dr. M. Garcia, **michael.r.garcia@nasa.gov**.

NASA will provide funding for travel to the ATHENA SST meetings.

The applications will be reviewed at NASA Headquarters. The Astrophysics Division Director will select the scientist for nomination to ESA.

NASA Point of Contact:
Dr. Michael Garcia
NASA ATHENA Program Scientist
Telephone: 202-358-1053
E-mail: **michael.r.garcia@nasa.gov**

US Athena SST SWG Membership

- NASA nomination, SST appointment
- Double Green light method
- Received 81 high-quality applications, all are now officially members of SWG
- Selected 24 for NASA travel funding
- Anticipate additional non-funded (endorsed) members, as application site re-opened until Dec 31, 2015

NASA Members in Athena SST Working Groups

Dear Colleague,

NASA is now soliciting applications and nominations for individuals affiliated with U.S. institutions to participate in the Working Groups which report to the ESA Athena (L2) Science Study Team.

Background: In November 2013, ESA selected the "Hot and Energetic Universe" as the theme of the second large mission (L2) in its Cosmic Vision program. The theme is to be addressed by an X-ray Observatory led by ESA, to be launched in 2028. On June 27, 2014 ESA announced that Athena is the mission concept to fulfill this theme (see http://sci.esa.int/cosmic-vision/54241-athena-to-study-the-hot-and-energetic-universe/) NASA is working with ESA to define the possible NASA contribution to this ESA-led X-ray mission.

ESA has assembled a Science Study Team (SST) to initiate the required study activities during the Assessment Phase of the Athena concept. The charge for the Athena SST can be found at http://www.cosmos.esa.int/web/athena/science-study-team. NASA is represented on this SST by Randall Smith of the CfA; Robert Petre (GSFC) and Michael Garcia (HQ) are ex-officio members of the SST. The Athena SST will be advised by a set of Working Groups which are being assembled at this time. The structure of, and Terms of Reference for, these Working Groups can be found at: http://www.cosmos.esa.int/web/Athena/community-wg.

NASA anticipates nominating ~1 NASA-nominated and SST-appointed scientist to be a member of each of these ~20 Working Groups. It is possible that some Working Groups will not require NASA representation, and that others may have more than one NASA-funded representative. NASA will provide travel funding to Working Group meetings for NASA-nominated working group members.

The SST may appoint additional US scientists to the working groups who are not nominated by NASA. NASA anticipates endorsing these additional US scientists to be appointed by the SST. NASA will provide no funding for working group members who are not NASA-nominated.

Nomination Letters: Applications and nominations to serve as NASA-nominated and/or NASA-endorsed member of the Athena SST Working Groups should consist of a two-page cover letter including a statement of which specific sub-WG is being applied for and expertise pertinent to serving on that Working Group, a one-page Curriculum Vitae including publications, and a statement of availability and commitment to serve on the Working Groups during their ~4 year lifetime.

Applications and nominations will be considered only for candidates affiliated with U.S. institutions.

Applications are due Monday Dec 1 at 5 pm EST. Only email applications of a single PDF file will be accepted. Please submit your application via email to Dr. M. Garcia, michael.r.garcia@nasa.gov.

NASA funding will be limited to travel to these Working Group meetings for NASA-nominated members.

The applications will be reviewed by the Physics of the Cosmos Program Office and by the Astrophysics Division at NASA Headquarters. The Astrophysics Division Director will select the scientists for nomination to the Athena SST, and those nominations will be forwarded to the Athena SST for possible appointment.

NASA Point of Contact:
Dr. Michael Garcia
202-358-1052
Michael.R.Garcia@nasa.gov

24 NASA Funded ASST SWG Members

Last	First	Organization	ASST Proposed Chair?	SWG
Allen	Steve	Stanford University	yes, for 1.1	1.1 Evolution of galaxy groups and clusters
Badenes	Carlos	University of Pittsburgh		3.4 Astrophysics of Supernova Remnants and the Instellar Medium
Ballantyne	David	Georgia Institute of Technology		2.2 Understanding the build-up of SMBH and galaxies
Bandler	Simon	NASA GSFC		5.4 End-to-end simulations
Brandt	Niel	Penn State University		2.1 Formation and growth of the earliest SMGH
Bregman	Joel	Univ of Michigan		1.1 Evolution of galaxy groups and clusters
Brenneman	Laura	SAO, Harvard e-mail	yes, for 2.0	2.4 Close Environments of Supermassive Black Holes
Donahue	Megan	Michigan State University		1.2 Astrophysics of galaxy groups and clusters
Galeazzi	Massimiliano	University of Miami		1.4 The missing baryons and the warm-hot intergalactic medium
Griffiths	Richard	University of Hawaii		3.5 Multiwavelength working group
Heinz	Sebastian	University of Wisconsin		1.3 AGN feedback in Galaxy clusters and groups
Hornschemeier	Ann	NASA GSFC	yes, for 3.2	3.2 Star formation and evolution

Last	First	Organization	ASST Proposed Chair?	SWG
Juda	Michael	Smithsonian		5.1 ground segment
Kallman	Timothy	GSFC		5.5, but not his first choice
Kilbourne	Caroline	GSFC		5.2 Background
Kouveliotou	Chryssa	NASA / MSFC		2.5 Luminous Extragalactic Transients
Miller	Jon	University of Michigan	yes, for 3.3	3.3 End points of stellar evolution (3rd choice)
Plucinsky	Paul	Smithsonian		5.3 Inter-Calibration sub-group of Mission Working Group(2nd choice)
Ptak	Andrew	NASA GSFC	yes, for 2.3	2.3 Astrophysics of feedback in local AGN
Reynolds	Christopher	University of Maryland		2.4 close environments of supermassive black holes
Smith	Randall	Smithsonian	yes, for 3.0	
Troja	Elenora	UMUC / GSFC	Yes, for 5.6	5.6 GRB external triggers and TOOs
Wolk	Scott	Smithsonian		3.1 Solar System and exoplanets
Zhang	William	GSFC		4 Telescope working Group

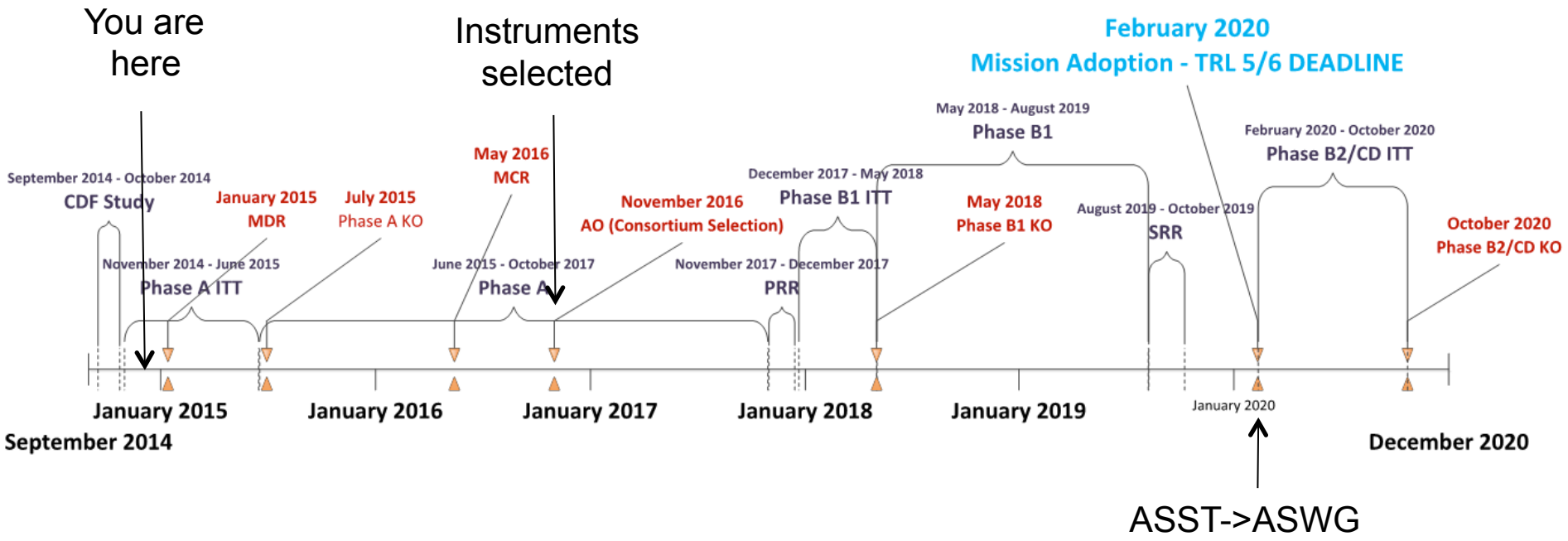
Instrument RFI

- Request for Information (RFI) released Dec 23, 2014
- Due date Feb 2, 2015
- Asked for possible instrument and instrument-enabling contributions
- Documented level of interest, possible types of contributions
- Endorsement of PI of instrument proto-consortia was required
- Informed NASA's program planning, including possible future solicitations
- Four responses: 2 for X-IFU, 2 for WFI, Science/Industry
- No need for US Instrument Solicitation (SALMON/ROSES)
- Program planning will be coordinated with ESA Instrument AO
  - Must allow NASA/Instrument PI sufficient time to incorporate contribution into proposal submitted ESA
  - Goal is to finish US process months before ESA AO due date
  - PIs can be involved in process before selections finalized
  - This is only process currently planned to allow NASA contributions to instruments

NASA Hardware Participation

- 2015: NASA is pursuing a partnership with ESA to provide up to $100-150M in components of the two instruments and/or the observatory.
  - NASA will provide the sensor array for the X-ray Integral Field Unit (microcalorimeter).
  - NASA is considering a proposal for contributions to the Wide Field Instrument (imager).
  - NASA is considering providing use of test facilities, specifically the X-ray Cryogenic Facility (XRCF) at MSFC.
  - NASA also plans for funding US members of the Athena science team, a US science data center, and US general observers during operation.
- NASA is budgeting for participation in the Athena mission, but such budgets come at an “opportunity cost” from other Astrophysics budget lines within a constrained budget.
- Based on report of the Midterm Committee (+), NASA will prioritize investments toward a role in Athena against other competing priorities.

Study Schedule



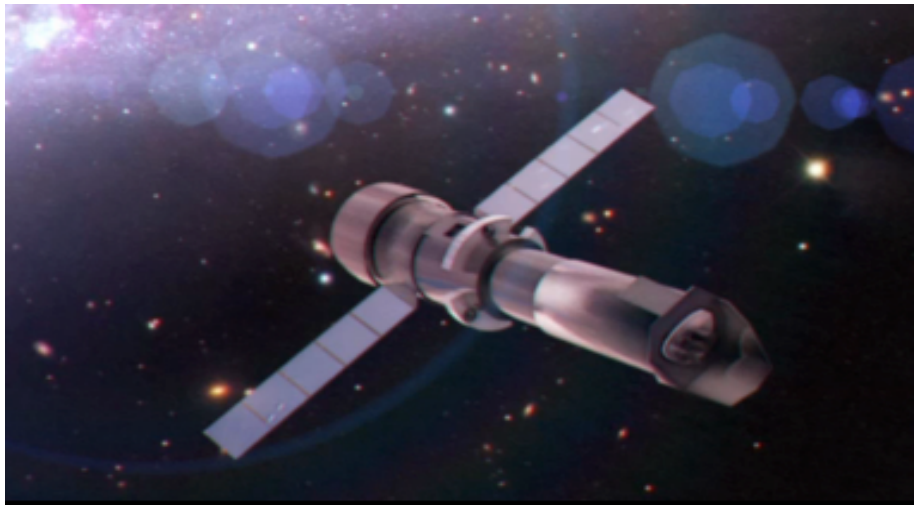
- Two configurations being studied:
  - As CDF determined meets 1B ESA cap, 1.4m^2
  - As proposed, 2.0m^2

- International contributions can be to Member States or ESA
- Instrument contributions may result in Guaranteed Time

BACKUP

Athena

Advanced **T**elescope for **H**igh **En**ergy **A**strophysics



- **Second ESA Cosmic Vision Large mission**
  - L-class with NASA/JAXA participation
  - Decadal Survey recommendation
  - Large X-ray mirror, X-IFU and WFI instruments
- **Launch Date:** 2028
- **Breakthrough Technologies**:
  - High Throughput, Wide FOV, High spectral resolution X-ray Astronomy
  - 10x Chandra area, 100x improved non-dispersive spectral resolution, 5x FOV.
- **Science Objectives**: The Hot and Energetic Universe: How does ordinary matter assemble into the large scale structures that we see today? How do black holes grow and shape the Universe?

CURRENT STATUS:

- Selected as 2nd Large mission in ESA Cosmic Visions Program
- Currently in 2 year Study Phase
- NASA and US community involved in Study Phase via membership on ESA-chartered Athena Science Study Team and Science Working Groups
- NASA budgeting for a $100M-$150M hardware contribution, plus a US GO program and a U.S. data center
- NASA will provide the sensor array for the X-ray Integral Field Unit (calorimeter)
- NASA and ESA are discussing other possible NASA contributions, such as:
  - A contribution to the Wide Field Imager
  - Use of the NASA XRCF for Calibration
  - Contribution to science data center (U.S. node)
- NASA continues to invest in Athena technologies via SAT and directed investigations.