

Draft

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**U.S. ATLAS Operations Program
Management Plan**

SUBMISSION AND APPROVALS

This Operations Program Management Plan defines the organization, systems and relevant interfaces for the U.S. Collaboration's participation in the operation of the ATLAS detector at the Large Hadron Collider (LHC) at the European Laboratory for Particle Physics (CERN), and in support of the physics investigations enabled by the detector. This management plan covers pre-operations, operations, detector maintenance, Upgrade R&D, and software and computing efforts required for successful U.S. participation in the Operations Program; in accordance with the DOE/NSF MOU and BNL Host Lab Letter (Reference 1 and Appendix 1). The U.S. role in the operation of the ATLAS detector is funded jointly by the U.S. Department of Energy and the National Science Foundation.

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1 INTRODUCTION

1.1 Operations Program Mission

The main goal of the U.S. ATLAS Operations Program (OP) is to meet international obligations for maintenance, operations, and computing to enable U.S. physicists to fully participate in the CERN Large Hadron Collider (LHC) physics program.

The OP consists of three major components: 1) Physics Analysis Support and Computing (including software and related hardware); 2) pre-operations, operations, detector maintenance and education/outreach (collectively referred to as M&O); and 3) Upgrade R&D. It is the mission of the U.S. ATLAS Operations Program to provide on-going support in these three areas for all U.S. groups. The goals in these three areas are:

- Physics Analysis Support and Computing (S&C) - provide support for the computer professionals and computing equipment that will assure that U.S. physicists will have access to data and provide their fair share of centrally managed computing for data analysis and Monte Carlo generation.
- M&O - provide support for the technical personnel required to maintain and operate the ATLAS detector. Those responsibilities follow naturally from the responsibilities of U.S. groups in the Construction Project.
- Upgrade R&D – invest in long-term detector research and development in order to be ready to upgrade the ATLAS detector for operations at an upgraded LHC with an initial peak luminosity of $\mathcal{L} = 3 \times 10^{34} \text{cm}^{-2}\text{s}^{-1}$ in ~2015, and with potential further anticipated increases in peak and integrated luminosities a few years after that.

1.2 Operations Program Scope

The U.S. ATLAS Operations Program supports the technical personnel and equipment required to accomplish its mission as described above. The scope includes:

- Assuring that all U.S. ATLAS Collaborators follow all required safety procedures
- Establishing program priorities consistent with funding agency guidance
- Providing fiscal accountability, and reporting functions
- Representing the U.S. in discussions with the international ATLAS management as National Contact Physicists (see Section 3.2.2)
- The support of physics analysis, but not the management of physics analyses
- The salary, travel and living expenses at CERN of technical personnel, but not the salary, travel or living expenses at CERN for physicists (i.e. graduate students, postdocs, scientists, faculty); physicists are expected to be supported by the U.S. “core” research program (with the exception of the Operations Program Manager and Deputy who are partially supported by the Operations Program.)
- The centrally managed computing facilities (Tier 1 and 2 centers), but not the institutional computing facilities (Tier 3 computing), which are expected to be supported by the “core” program although the OP provides some support (see Section 3.2.4.3) for integrating the Tier 3 facilities into the U.S. ATLAS Tier 1 and Tier 2 centers.

1.3 International Obligations

It is the responsibility of the U.S. ATLAS Operations Program to meet all international obligations as defined in various protocol documents.

The most relevant documents are the Memorandum of Understanding (MOU) for M&O of the ATLAS Detector between CERN and the Funding Agencies of the Collaboration (CERN-RRB-2002-035) and the ATLAS Memorandum of Understanding between CERN and the ATLAS funding agencies governs the Worldwide LHC Computing Grid (WLCG) aspects of the LHC Operations Program.

1.4 External Program Oversight

A Joint Oversight Group (JOG), co-chaired by representatives of the DOE and the NSF, performs periodic reviews and assesses technical, schedule and cost performance. The JOG also conducts an annual management performance review. The specific responsibilities of the JOG are addressed in a MOU between the DOE and the NSF on U.S. participation in the LHC Program and the Operations Program Execution Plan (Reference 1).

1.5 The U.S. ATLAS Collaboration

The U.S. ATLAS Collaboration, as referred to in this document, consists of scientists and technical staff from U.S. universities and national laboratories (a list of U.S. ATLAS Participating Institutions can be found: http://www.usatlas.bnl.gov/USATLAS_TEST/institutes,%20reps,%20emails.htm). The scientists are those who are qualified for authorship or working towards qualification in the international ATLAS Collaboration. Current institutional responsibilities in S&C, M&O and Upgrade R&D are shown in Appendix 2. Any U.S. institutions admitted to the ATLAS Experiment are automatically included in the U.S. ATLAS Collaboration. Some institutions participate in ATLAS as affiliated institutions by partnering with already existing ATLAS members (typically national laboratories).

U.S. physicists on ATLAS will be involved in the analysis of data from the experiment and we expect these scientists to be leading contributors to the physics analysis. Funding for physicists at the U.S. ATLAS institutions and the conduct of their activities will not be managed under the Operations Program. The salaries and expenses of scientific personnel for U.S. ATLAS will be provided via the Core Research Program together with their home institutions. Individual institutions may also provide technical support that is not funded, and hence not managed, by the Operations Program, although every effort is made to align their activities with the priorities of this program.

MOUs are written for any Operation Program Funding with representatives of the institution, the U.S. ATLAS Operations Program Office and the Host Laboratory.

1.5.1 Institutional Board

The U.S. ATLAS Collaboration has an Institutional Board (IB) with one member from each collaborating institution and a Chair elected by the Board. The Chair serves for a three-year renewable term. The IB will normally meet monthly. Periodically the Designated Laboratory Official (DLO) (see Section 3.1) will participate to provide feedback from the funding agencies and to collect input from the IB concerning program management performance and issues. Under normal circumstances the meetings are open to the Collaboration, although closed meetings may be called by the Chair to discuss detailed or difficult issues. Only IB members or their designates can vote on any question.

The IB members represent the interests of their institutions, and serve as contacts between the U.S. ATLAS management structure and the collaborators from their institutions, who select their respective representatives.

The Institutional Board deals with general issues of policy affecting the U.S. ATLAS Collaboration. For example, the IB discusses applications of new institutions to join ATLAS and forwards the conclusion to the U.S. ATLAS Operations Program Manager. The IB Chair organizes meetings on issues of general interest and represents U.S. ATLAS on issues that affect the Collaboration. The Chair facilitates the formation and operations of ad hoc committees to run elections for which the IB

is responsible, including those for the at-large members of the Executive Committee (see Section 3.2.7) and for IB Chair. The committees must be approved by the IB. The Chair recommends to the Institutional Board the establishment of any standing committees to deal with Collaboration-wide issues if the need arises. A Subcommittee of the Institutional Board appointed by the IB Chair also provides its recommendation on the appointment of the Operations Program Manager and Deputy to the BNL DLO, and to the JOG.

U.S. ATLAS IB Nomination Committees for Operations Program Management positions will consist of the Operations Program Manager (OPM) and Deputy (DOPM), IB chair and 3 U.S. ATLAS members appointed by the IB chair. The IB Chair serves as the chair of the Committee. The Committee will solicit nominations from the U.S. ATLAS IB representatives with no limit to the number of nominations. The solicitation will include a job description, the term limit, and the name of the outgoing person (if applicable). The list of people nominated is not released to the collaboration. If the nomination list is more than 3 people, the Committee will select a short list of no more than 3 names to send to the OPM for the appointment. The Committee will check with potential candidates to confirm that they are willing to serve. The nominations are due one month after the Committee is formed. The OPM will bring the selected person to the IB for concurrence before the position is announced.

1.6 The ATLAS Detector

The ATLAS detector was built by a large international collaboration. The detector consists of an inner tracking system with silicon pixels, silicon strips and a transition radiation tracker; a liquid argon calorimeter; a scintillating tile hadronic calorimeter; a muon spectrometer; a trigger and data acquisition system, and the associated computing for data analysis. A superconducting solenoid and superconducting toroid magnets provide charge and momentum measurements of charged-particle products of the collisions. U.S. groups are involved in almost all of these components of the ATLAS detector. Detailed descriptions of all these systems are given in the Technical Design Reports (<http://atlas.web.cern.ch/Atlas/internal/tdr.html>).

1.7 Document Scope

In the following sections we describe the U.S. ATLAS management structures, roles, and responsibilities addressing Maintenance and Operations, Software & Computing and Upgrade R&D activities that constitute the U.S. ATLAS Operations Program.

This program began with pre-operation of completed components of the detector before the turn-on of the initial detector. It includes U.S. responsibilities for M&O of the detector and its subsystems and for Upgrade R&D for the detector. Upgrades, if approved, will lead to a new Upgrade Construction Management Plan. The Operations Program of the ATLAS experiment will last for an indefinite time after the turn-on in 2009 but is expected to extend for at least 20 years, as established in the “International Cooperation Agreement” between CERN and the U.S. (Reference 2).

2 ATLAS OBJECTIVES

2.1 Scientific Objectives

A fundamental unanswered problem of elementary particle physics relates to the understanding of the mechanism that generates the masses of the W and Z gauge bosons and of quarks and leptons. To attack this problem requires an experiment that can examine a large rate of particle collisions at very high energy. The LHC will collide protons against protons every 25 ns at a design center-of-mass energy of 14 TeV and a luminosity of $10^{34} \text{ cm}^{-2} \text{ s}^{-1}$. The ATLAS scientific objectives are to make this and other discoveries fundamental to particle physics.

2.2 Technical Objectives

The objective of the Operations Program is to keep the ATLAS detector operating for twenty or more years at the CERN LHC, observing collisions of protons and heavy ions, and recording more than 10^9 events per year. The ATLAS detector is designed to meet the physics goals, but reliable operation of the detector is also required to meet the physics objectives. Appropriate attention must be paid to the calibration of each detector element, the selection and implementation of triggers, the maintenance of electronics, software for calibration and databases, and the maintenance and operation of gas and cryogenic systems, and alignment systems.

Upgrades to the initial detector will be needed. CERN has approved a Phase 1 Upgrade of the LHC with $L = 3 \times 10^{34} \text{ cm}^{-2} \text{ s}^{-1}$ planned to be operational in ~2015. In addition, further needs may be identified through the improved understanding of both the physics and the detector capabilities, following the early operation of the experiment. A major upgrade is being studied for the next decade. Any proposed upgrades will have a well-defined approval procedure within ATLAS, as well as thorough outside peer and U.S. agency reviews for the portions of the detector funded by the U.S. In order to be prepared for any future upgrades to the ATLAS detector, the necessary R&D must be carried out.

2.3 Cost and Schedule Objectives

The cost objectives are to provide the necessary shared funds of the ATLAS detector. The overall ATLAS management team makes an annual estimate of common operating costs and approves these budgets by the Collaboration Board. These estimates include category A and B items. Category A represents common responsibilities such as cryogenic and detector operations, on-line computing, and general CERN services such as rigging and survey. Category B represents costs for a particular system in ATLAS, such as the M&O of front-end electronics, low and high voltage power supplies, read out modules, control systems, spares and shared technicians. Both Category A and B costs are shared proportional to the fraction of Ph.D. authors in each country. Detailed schedules for installation, commissioning, operations and maintenance are developed by the ATLAS Technical Coordination organization. There is an MOU for Collaboration in the Deployment and Exploitation of the LHC Computing Grid (CRRB-D200). This MOU reflects the U.S. pledges for Tier 1 and Tier 2 computing facilities. An Addendum of this MOU for Core Computing specifies the software professionals needed for ATLAS and the U.S. in-kind contribution to this effort.

3 MANAGEMENT STRUCTURES

3.1 Host Laboratory

The DOE and NSF have assigned BNL management oversight responsibility for the U.S. ATLAS Operations Program (see Appendix 1). The BNL Director has the responsibility to assure that the operations effort is being managed soundly, that technical responsibilities are executed in a timely way, that technical or financial problems, if any, are being identified and properly addressed, and that the management organization is in place and functioning effectively. The BNL Director has delegated certain responsibilities and authorities to the Designated Laboratory Official (DLO), who at BNL is the Associate Laboratory Director for Nuclear and Particle Physics (ALD). The DLO is responsible for management oversight of the Operations Program and the U.S. ATLAS Operations Program Manager reports to him/her. Specific responsibilities of the DLO include:

Appointments:

1. Appointing the U.S. ATLAS Operations Program Manager and Deputy, after soliciting recommendations from the U.S. ATLAS Institutional Board, for a renewable term of three years, subject to the concurrence of the Joint Oversight Group and U.S. ATLAS IB (see Appendix 5). The process shall include JOG concurrence on the initial DLO charge to the IB and timeline for

the appointment process as well as periodic updates from the DLO to the JOG on formation of an IB subcommittee, IB recommendations, etc.

Oversight and Consultation:

2. Establishing an advisory structure external to the U.S. ATLAS Operations Program for the purpose of monitoring both management and technical progress for all U.S. ATLAS activities;
3. Ensuring that there is accurate and timely reporting to the U.S. LHC Operations Program Office;
4. Consulting regularly with the Operations Program Manager to assure timely resolution of management challenges;
5. Meeting periodically with the U.S. ATLAS Institutional Board to discuss management and other issues;
6. Meeting periodically with the JOG;
7. Holding coordinating meetings with designated management officials from the other national laboratories involved in U.S. ATLAS, to insure constructive cooperation in pursuit of U.S. ATLAS goals. The OPM and Deputy are full members of these meetings.

Management:

8. Conduct an annual performance appraisal of the Operations Program Manager and Deputy and report to the funding agencies and the IB;
9. Assuring that the Operations Program Manager has adequate staff and support, and that U.S. ATLAS management systems are matched to the needs of the tasks;
10. Concurring with any International Memoranda of Understanding specifying U.S. responsibilities for the U.S. ATLAS Operations Program funded by DOE and NSF;
11. Concurring with the institutional Memoranda of Understanding for the U.S. ATLAS collaborating institutions that specify responsibilities and resources for each institution;
12. Approving Operations Program Change Proposals, as indicated in Section 4.6.1, which includes any use of Management Reserve.

As the host laboratory for U.S. ATLAS, BNL will have the following responsibilities:

1. Staffing and operating the U.S. ATLAS Operations Program Office, consistent with recommendations by the U.S. ATLAS Operations Program Manager;
2. Operating and upgrading, as needed, the U.S. ATLAS Tier 1 center for computing support consistent with the recommendations of the U.S. ATLAS Operations Program Manager. If the costs of upgraded Tier 1 infrastructure exceed the available BNL overhead resources, the laboratory will be responsible for identifying cost-sharing with the U.S. ATLAS Operations Program funds.
3. Hosting periodic workshops and analysis jamborees to promote full and active involvement of U.S. collaborators in extracting physics from ATLAS data. Other institutions in the U.S. hold similar activities.

3.1.1 External Advisory Structure

The Designated Laboratory Official appoints the Detector and Computing Advisory Panel (DCAP), consisting of individuals outside of the U.S. ATLAS Collaboration with expertise in technical areas relevant to the Operations Program and the management of large projects. The DCAP assists the DLO in oversight responsibility for the work performed in the Operations Program, including the operation of the detector, work on Upgrade R&D and Computing, and provides advice on the rate of progress and adherence to the operations plan as it relates to cost, schedule and technical performance.

The primary mechanism for performing this oversight role is through the Operations Program Manager's reviews at least once per year of the U.S. ATLAS subsystems, followed by discussions among the attending DCAP members and U.S. ATLAS principals and Subsystem Managers. If necessary, additional mechanisms may be employed as deemed necessary to exercise the oversight function. These can include special reviews or meetings of the U.S. ATLAS Operations Program. The DCAP reports to Laboratory management by means of verbal discussions and written reports following each major DCAP review. DCAP reports are transmitted to DOE and NSF and the U.S. LHC Operations Program Office. The DLO works with the OPM to address any problems uncovered in these reviews.

3.1.2 DOE Funding

The DOE Office of Science has delegated financial accountability to BNL inclusive of line management authority, responsibility and accountability for overall implementation of operations, and contract administration. The BNL Program Office is responsible for dispersal of DOE funds according to the allocations recommended by the U.S. ATLAS Operations Program Manager, and in accordance with DOE policies.

3.1.3 NSF Funding

The NSF Division of Physics has delegated financial accountability currently to Columbia University inclusive of line management authority, responsibility and accountability for overall implementation of operations, and contract administration. The Director of Nevis Laboratory of Columbia University is responsible for dispersal of NSF funds according to the allocations recommended by the U.S. ATLAS Operations Program Manager, and in accordance with NSF policies.

3.2 U.S. ATLAS Management Structures

An Operations Program Management structure has been established to facilitate interactions with U.S. funding agencies and for effective management of U.S. ATLAS activities and resources. This structure is supported by the Operations Program Offices located at the host lab, BNL, and at the university that is the home institution of the Operations Program Manager or Deputy, currently Columbia University, and is in accord with the letter (see Appendix 3) from the Joint Oversight Group to the BNL Director requesting that a U.S. ATLAS Operations Program Manager and Deputy Operations Program Manager be appointed.

Figure 1. U.S. ATLAS Organization Chart

U.S. ATLAS Operations Program Organization as of March 1, 2012

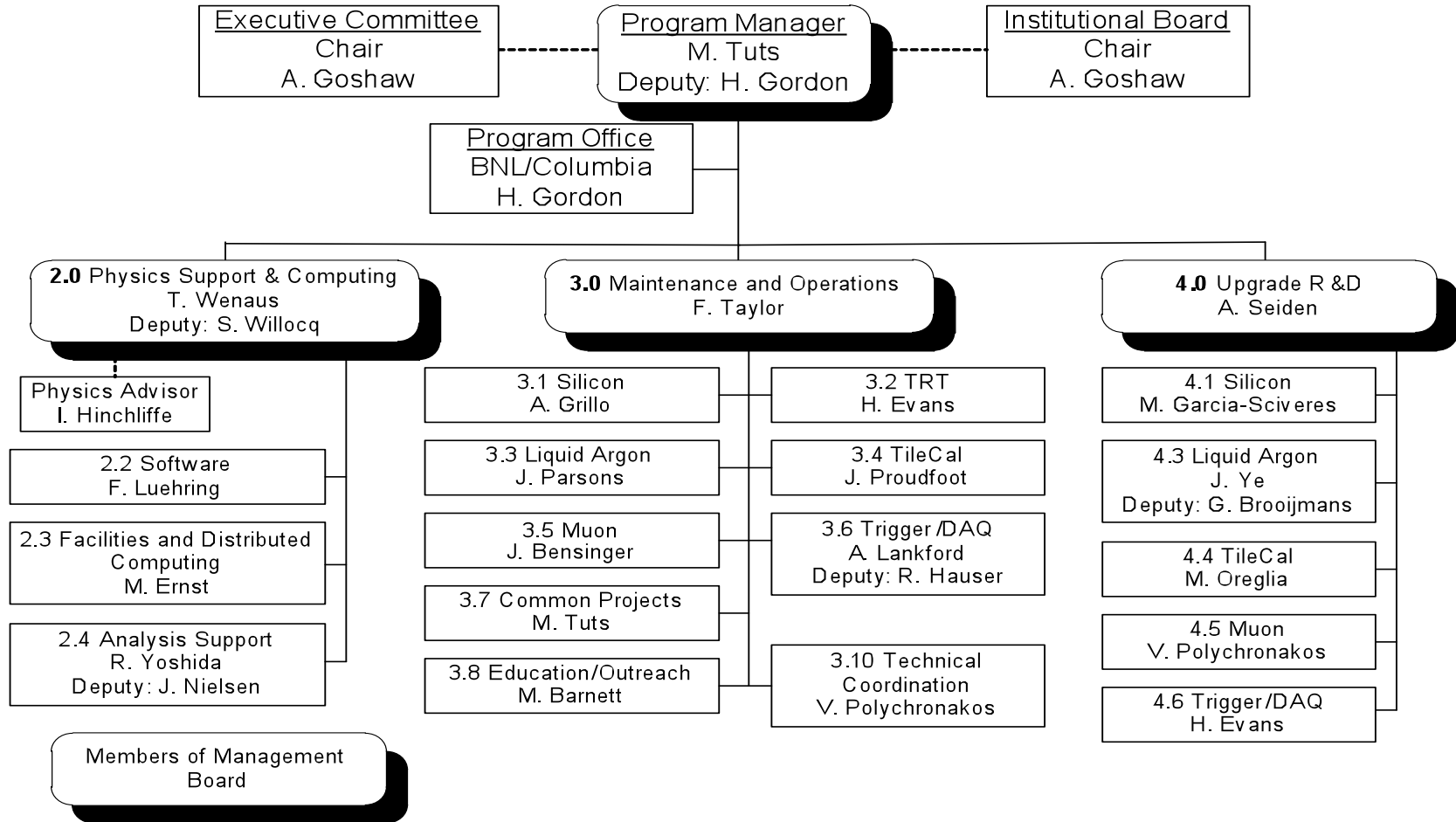


Figure 1 shows the organization chart for the U.S. ATLAS Operations Program. The details of the appointment of each position are found in Appendix 5. The Operations Program is headed by the U.S. ATLAS Operations Program Manager and Deputy. Reporting directly to the Operations Program Manager are the M&O Manager, the Upgrade R&D Manager and the Physics Support and Computing Manager. The organization also includes an Institutional Board (IB) with representatives from each collaborating institution, an Executive Committee (EC), and a Management Board. The responsibilities of each are described below. U.S. ATLAS planning and management is done in close cooperation with the overall ATLAS management team. The U.S. Subsystem Managers interact closely with the corresponding overall ATLAS System Leaders, and there is also close cooperation between the Physics Support and Computing Manager and his/her central ATLAS counterpart. The U.S. ATLAS Operations Program Manager and Deputy maintain close contact with the ATLAS Spokesperson, Deputy Spokespersons, and the Technical and Resource Coordinators.

3.2.1 Program Office

The U.S. ATLAS Operations Program Office (OPO) is co-located at the Host Laboratory, Brookhaven National Laboratory, and at Columbia University. It provides technical coordination and financial management support to the Operations Program Manager and Deputy. The Operations Program Manager or Deputy provides direction to the staff and manages its day-to-day operations. This office is staffed to coordinate administrative and technical activities of U.S. ATLAS including:

- Annual preparation of the budget.
- Financial and technical reporting.
- Development of proposals for any future upgrade of the detector.

The staff includes a Planning Manager and additional staff. The Operations Program Office has the responsibility of reviewing and issuing contracts in support of operations activities. This includes funding specific activities at collaborating U.S. institutions.

3.2.2 U.S. ATLAS Operations Program Manager and Deputy

The U.S. ATLAS Operations Program Manager and Deputy have the responsibility of providing programmatic coordination and management for the U.S. ATLAS Operations Program. The duties are shared between the Manager and Deputy to be arranged by them. In the rest of this section the Manager and Deputy are considered a single person. He/she represents the U.S. ATLAS Operations Program in interactions with international ATLAS management, CERN, DOE, NSF, the collaborating universities and laboratories, and with BNL, the Host Laboratory, on all issues concerning the Operations Program. He/she is advised by an Executive Committee (EC), as described in 3.2.7.

The Operations Program Manager makes major technical and managerial decisions in consultation with the Management Board, as described in 3.2.3 ensuring that the U.S. ATLAS Operations Program meets its responsibilities for technical developments and maintenance to international ATLAS. His/her responsibilities include:

Management Structure:

1. Appointing, with the concurrence of the IB, the Physics Support and Computing Managers, the U.S. ATLAS Manager for M&O, the Upgrade Manager, and the Physics Advisor. Each of these appointees serves for a renewable two year term. Candidates are solicited from the U.S. ATLAS IB.
2. Establishing, with the support of BNL and Columbia management, a U.S. ATLAS Operations Program Office offering appropriate support services.
3. Working with BNL management and the U.S. LHC Operations Program Office to set up and respond to other mechanisms needed to carry out oversight responsibility.

4. Serving with the Deputy as National Contact Physicists for ATLAS. In the ATLAS experiment the Resource Coordinator calls meetings of the National Contact Physicists (NCP) who serve as a liaison between the experiment and the funding agencies in the 37 countries. The NCP meetings discuss budget and funding issues.

Resource Management:

5. Preparing the yearly funding requests to DOE and NSF for the anticipated U.S. ATLAS Operations Program.
6. Preparing, submitting and serving as PI for the NSF Operations Program 5-year grant.
7. Recommending to DOE and NSF the institution-by-institution U.S. ATLAS Operations Program funding allocations to support the U.S. ATLAS Operations Program. These recommendations are made in consultation with the U.S. ATLAS Management Board. For the universities the funding is via contracts from BNL and Columbia University. For DOE Laboratories, letters recommending funding are sent to the U.S. LHC Program Office Manager.
8. Approving budgets and allocating funds in consultation with the Management Board and allocating Management Reserve funds, in accord with the Change Control Process in Section 4.6.1.
9. Interacting with CERN and ATLAS management on issues affecting resource allocation and availability, and preparation of international MOUs defining U.S. responsibilities and signing these MOUs.
10. Negotiating and signing the U.S. institutional MOUs representing agreements between the U.S. ATLAS Operations Program Office and the U.S. ATLAS collaborating institutions specifying responsibilities and resources available on an institution-by-institution basis.

Reporting:

11. Keeping the BNL Director or representative and the U.S. LHC Operations Program Office well informed on progress of the U.S. ATLAS Operations Program, and reporting promptly any problems whose solutions may benefit from joint efforts of the Operations Program Manager, BNL management and the U.S. LHC Operations Program Office.
12. Advising the DOE and NSF representatives at the ATLAS Resource Review Board meetings.
13. Reporting periodically on U.S. ATLAS Operations Program status and other issues to the U.S. LHC Operations Program Office and the Joint Oversight Group.
14. Representing the U.S. ATLAS Operations Program in discussions with funding agencies and planning bodies, including the American Physical Society (APS) Division of Particles and Fields and High Energy Physics Advisory Panel (HEPAP).
15. Meeting monthly with the U.S. ATLAS Management Board to discuss budget planning, milestones, and other U.S. ATLAS management issues.
16. Meet at least quarterly with the Executive Committee to discuss longer term strategic issues. Such issues are the long term planning of the balance between M&O, S&C and Upgrade R&D.
17. Making monthly reports to the U.S. ATLAS Institutional Board to ensure that the Collaboration is fully informed about prevailing issues. In particular funding priority decisions should be reported quarterly.
18. Submitting quarterly reports to the U.S. LHC Program Office, DOE and NSF including metrics (see Appendix 7).

Safety and Institutional Interactions:

19. Overseeing ES&H and QA/QC Management for the U.S. institutions.
20. Meeting with each U.S. ATLAS institution yearly to review their personnel, activities, and ATLAS authors.

The channels for Operations Program funding, reporting, and transmission of MOUs are shown in Appendix 6. DOE Operations Program funding will be a mixture of grants and Operations Contracts through BNL. NSF Operations Program funding will be carried out via subcontracts through Columbia University. Further details on the titles and roles of participants in the governance of the U.S. ATLAS Collaboration are given below.

3.2.3 U.S. ATLAS Management Board

The U.S. Management Board is chaired by the Operations Program Manager and meets monthly to discuss U.S. ATLAS wide resource issues, approve annual budgets, and approve requests for funds from Management Reserve. Its membership includes the Operations Program Manager serving as Chair, the Deputy Operations Program Manager (DOPM), the Physics Support and Computing Manager, the M&O Manager and the Upgrade R&D Manager.

3.2.4 Physics Support and Computing Manager (PSCM) and Deputy (DPSCM) (WBS 2.0)

The Physics Support and Computing Manager and Deputy serve for renewable two year terms, appointed by the OPM with input from and the concurrence of the IB. They are also responsible for understanding the impacts and representing U.S. ATLAS concerns in the technical, schedule and cost aspects of U.S. ATLAS Computing, and overseeing the work of the Level 2 Software, Facilities, and Analysis Support Managers. They develop the budgets for the participating institutions for computing and physics support. The PSCM and DPSCM are responsible for technical, managerial, and schedule interactions with broader external entities associated with the U.S. ATLAS Computing and Physics program. Examples of such entities are the DOE and NSF, BNL, the Worldwide LHC Computing Grid (WLCG) project, and the Open Science Grid (OSG).

The management responsibilities of the PSCM include:

Management Structure:

1. Appointing the Level 2 managers for Software, Facilities and Distributed Computing, and Analysis Support Managers with the concurrence of the Operations Project Manager and the Institutional Board.
2. Providing coordination and management direction to the Level 2 Managers, including requirements for appropriate reporting and tracking, and responses to technical reviews.
3. Recommend to the Operations Project Manager long-term strategies for funding needs of the physics support and computing program.
4. Establishing advisory committees.
5. Conduct weekly meetings of the U.S. Level 2 Computing Managers.
6. Establishing and maintaining the organization of the Work Breakdown Structure and milestone tracking with the help of the U.S. ATLAS Operations Program Office; this includes the management of procurements, schedules, reporting, etc.
7. Developing the annual budget request for the Operations Project Manager. This will include a prioritized list of tasks and the associated budgets.
8. Reviewing and recommending approval of Memoranda of Understanding (MOU) between CERN and the U.S. ATLAS Operations Program concerning software and computing.

9. Preparing change control requests within program change control protocols.
10. Reviewing and recommending approval of institutional Memoranda of Understanding related to computing between the Operations Project Manager, the Designated Laboratory Official, and U.S. ATLAS institutions.
11. Representing the U.S. in the ATLAS International Computing Board (ICB) which concurs on decisions that affect ATLAS computing resources.
12. Advise the OPM and the DOE/NSF on matters arising in the LHCC Computing Resources Review Board (C-RRB).

Coordination and Oversight:

13. Acting as liaison between the Operations Program and the ATLAS Computing management, in particular in matters with broader impact and long-range effect such as the grid computing efforts.
14. Act as a liaison between the Operations Program and the WLCG.
15. Act as a liaison between the Operations Program and other relevant grid projects such as the OSG.
16. Acting as a liaison between U.S. ATLAS physics support and computing efforts and the ATLAS Computing management on matters concerning the WBS, manpower and U.S. deliverables, including M&O Category A and B computing issues.
17. Coordination of long-term computing strategies with U.S. funding agencies, other U.S. organizations (U.S. CMS, regional centers, other sciences), International ATLAS and CERN.

Reporting Activities:

18. Providing reports and organizing reviews in conjunction with the U.S. LHC Operations Program Office.

3.2.4.1 Physics Advisor

The Physics Advisor is charged with providing advice to the PSCM to ensure that the overall goals of LHC physics are considered in any decision-making process. The Physics Advisor also acts as a U.S. ATLAS liaison to ATLAS physics management, advises U.S. ATLAS physicists and ensures that U.S. physicists are aware of developments in ATLAS physics. The Physics Advisor is appointed by the Operations Program Manager for a two year renewable term, with the concurrence of the PSCM and the Institutional Board.

3.2.4.2 Software Manager (WBS 2.2)

The Software Manager (SM) is a WBS Level 2 manager responsible for the technical, schedule, and cost aspects of U.S. work on ATLAS software. The SM appoints the WBS Level 3 managers for Core Services, Data Management, Application Software, and Infrastructure Support in consultation with PSCM and DPSCM. The Software Manager develops the priorities for software and then recommends the budgets for the institutions participating in work on software. The Software Manager is appointed for a renewable two-year term by the PSCM with the concurrence of the Operations Program Manager and the Institutional Board.

3.2.4.3 Facilities and Distributed Computing Manager (WBS 2.3)

The Facilities and Distributed Computing Manager is a WBS Level 2 manager responsible for the technical, schedule, and cost aspects of U.S. ATLAS computing facilities. The U.S. ATLAS Facilities Organization provides the support for the managed computing facilities used for the analysis of data by U.S. ATLAS physicists and carries out specific computing tasks for the International ATLAS experiment as agreed in the WLCG MOU. The Facility Manager's responsibilities include

Level 3 tasks involving the national Tier 1 computing center at Brookhaven National Laboratory; the 5 U.S. ATLAS Tier 2 centers; Tier 3 technical support; Distributed Computing; implementation of grid software; optimizing use of resources; and networking. Level 3 Managers will be appointed by the Facilities and Distributed Computing Manager for each of these tasks. The Facilities and Distributed Computing Manager is appointed by the PSCM for a two year renewable term, with the concurrence of the Operations Program Manager and the Institutional Board.

3.2.4.3.1 U.S. T3 Coordinator (WBS 2.3.7)

The U.S. Tier-3 Coordinator, a level 3 manager, is responsible for maximizing the effectiveness of U.S. Tier-3's for ATLAS analysis. He/She will coordinate the efforts of the institutes to bring up Tier-3's, operate them, and to integrate them into the U.S. ATLAS computing system.

In this regard, the U.S. Tier-3 Coordinator will be required to:

- have close consultation with the U.S. ATLAS Analysis Support Manager.

Tier-3's are a major component of physics analysis machinery and as such, the configuration and use must fit in well with the needs of the U.S. Physics Analysis users. Hence the Tier-3 Coordinator and the deputy must work closely with, and be responsive to, the needs and requirements put forward by the U.S. ATLAS Analysis Support Manager to ensure that the Tier-3s meet the U.S. physics analysis requirements.

- have close integration with external grid projects like the OSG.

The U.S. infrastructure is built upon the base OSG middleware. The Tier-3s must mesh well with this infrastructure.

- have close integration with the U.S. ATLAS Facilities and Distributed Computing Manager.

The Tier-3s will have limited support. They must be configured to have minimal impact on the larger U.S. infrastructure. This requires that the Tier-3 Coordinator reports directly to the U.S. Facilities and Distributed Computing Manager.

The position needs to have a single person contact, but could have a deputy as noted in point 6 below, to assist in these duties. The separation of the duties in the case of a deputy is left to the two parties involved with the Facilities and Distributed Computing Manager's approval.

The T3 Coordinator will:

1. Ensure that the U.S. Tier-3 institutes have sufficient guidance and support to build, maintain and integrate their Tier-3 into U.S. facilities. He/She will coordinate the overall effort to maximize the available Tier-3 analysis computing resources for U.S. ATLAS institutes.
2. Develop, in coordination with the Tier-1 and Tier-2, an overall integration plan and architecture of the U.S. Tier-3 centers so that they fit smoothly into the overall U.S. Facilities.
3. Serve as the interface to the Facilities, Facilities management, ATLAS management, U.S. ATLAS Management and OSG.
4. The Tier-3 Coordinator, in accord with the Facilities and Distributed Computing Manager, has the final authority on the inclusion/exclusion of any Tier-3 site into the U.S. ATLAS computing system. In case a Tier-3 causes, or has a potential to cause serious disruption to U.S. facilities operations, the Tier-3 Coordinator in accord with the Facilities and Distributed Computing Manager has the right to suspend such Tier-3s from the U.S computing system until the problem has been corrected.
5. Oversee a Tier-3 Technical Task force comprising expertise from both the facilities and the user community to provide technical support to the commissioning and integration plan and implementation.

6. The Tier-3 Coordinator may appoint a deputy to assist him/her in his/her role. The explicit responsibilities of the deputy must be worked out between him/her and the Tier-3 Coordinator and must be approved by the Facilities and Distributed Computing Manager and the U.S. ATLAS management. The responsibilities of the deputy include (but is not limited to) providing technical support to the U.S. Tier-3 institutes to implement the necessary ATLAS and non-ATLAS software and configure their sites to effectively pursue an analysis in ATLAS physics.
7. The Tier-3 Coordinator and/or his/her deputy will conduct site visits as necessary to assist the Tier-3 sites in their commissioning and integration efforts.

3.2.4.4 Analysis Support Manager (WBS 2.4)

The Analysis Support Manager is a WBS Level 2 manager for the technical, schedule and cost aspects of U.S. Analysis Support. He/she has the overall responsibility of ensuring that U.S. physicists have access to the necessary software tools and support to enable them to participate effectively in the LHC physics program. He/she is also the Chair of the Analysis Support Group (ASG, WBS 2.2.6) and is appointed by the PSCM for a two year renewable term, with the concurrence of the Operations Program Manager and the Institutional Board.

3.2.5 M&O Manager (WBS 3.0)

The M&O Manager is responsible for the technical, scheduling, and cost aspects of the M&O subsystems.

Funding:

1. Recommend to the Operations Program Manager long-term strategies for funding needs of the M&O program.
2. Developing the annual detailed budget request for the Operations Program Manager.
3. Preparing change control requests within program change control protocols.
4. Reviewing and recommending approval of institutional Memoranda of Understanding (IMOU) between the U.S. ATLAS Operations Program Office and U.S. ATLAS institutions.

Coordination and Oversight:

5. Establishing and maintaining the organization of the Work Breakdown Structure with the help of the U.S. ATLAS Operations Program Office; this includes the management of any procurements, milestones, schedules, reporting, etc.
6. Providing coordination and management direction to the subprojects, including requirements for appropriate reporting and tracking, and responses to technical reviews.
7. Conducting meetings of the Level 2 Subsystem Managers approximately every two weeks.
8. Establishing advisory committees.

3.2.5.1 Subsystem Managers

The Subsystem Managers (for Silicon, TRT, Liquid Argon, TileCal, Muon, Trigger/DAQ, and Technical Coordination) are responsible for the technical, schedule, and cost aspects of the M&O for their subsystems. They are appointed by the U.S. ATLAS M&O Manager for two year renewable terms upon recommendation of the IB members whose institutions are involved in that subsystem and with the concurrence of the Operations Program Manager. They develop budgets for the institutions participating in their subsystems.

3.2.5.2 Education/Outreach Coordinator (WBS 3.8)

The Education/Outreach Coordinator, appointed by the OPM, is expected to champion educational programs associated with ATLAS and with the U.S. member institutions, to report to the Executive Committee and IB on these issues, and to act as liaison to DOE and NSF for educational activities. The intended audiences for these education activities are a) the general public, b) secondary school students, c) undergraduates, and d) primary and secondary school teachers. The M&O Manager is responsible for budget requests from the Education/Outreach Coordinator.

3.2.6 Upgrade R&D Manager (WBS 4.0)

The Upgrade R&D Manager is responsible for technical, schedule and cost aspects of U.S. ATLAS Upgrade R&D. This R&D is focused on developing detectors for the Phase 1 of the LHC Upgrade currently planned for installation in ~FY2015 with a luminosity of $3 \times 10^{34} \text{ cm}^{-2} \text{ s}^{-1}$ and for a possible Phase 2 with luminosity of $10^{35} \text{ cm}^{-2} \text{ s}^{-1}$. The management responsibilities of the Upgrade Manager include:

Funding:

1. Development of long-term strategies for funding needs for the Upgrade program and for adjusting the scope of the upgrades to the available funding.
2. Establishing and maintaining the organization of the Work Breakdown Structure with the help of the U.S. ATLAS Operations Program Office; this includes the management of any procurements, milestones, schedules, reporting, etc.
3. Developing the annual detailed budget request for the OPM.
4. Preparing change control requests within program change control protocols.

Oversight and Coordination:

5. Providing coordination and management direction to the subprojects, including requirements for appropriate reporting and tracking, and responses to technical reviews.
6. Establishing advisory committees where appropriate.
7. Reviewing and recommending approval of institutional Memoranda of Understanding (IMOU) between the U.S. ATLAS Operations Program Office and U.S. ATLAS institutions.
8. Conducting meetings of the Level 2 Subsystem Managers approximately every two weeks.

3.2.6.1 Upgrade Subsystem Managers (USM)

The Subsystem Managers (for Silicon, Liquid Argon, TileCal, Muon, and Trigger/DAQ) are responsible for the technical, schedule, and cost aspects of the Upgrade for their subsystems. They are appointed by the U.S. ATLAS Upgrade Manager for two year renewable terms upon recommendation of the IB members whose institutions are involved in that subsystem. They develop budgets for the institutions participating in their subsystems.

3.2.7 U.S. ATLAS Executive Committee

The U.S. ATLAS Executive Committee, chaired by the IB Chair, meets quarterly and advises the OPM on broader issues of long range significance and strategy. Its membership consists of the U.S. ATLAS Management Board, the Chair of the Institutional Board and three U.S. ATLAS members at large elected by the IB for renewable three year staggered terms. These at large members should be chosen for their independence and broad knowledge about ATLAS. Typical activities would be to conduct long range strategic planning, review the balance of the Operations Program and upcoming presentations from U.S. ATLAS and provide comments.

4 MANAGEMENT SYSTEMS

4.1 Work Breakdown Structure

Project Management procedures, as described in this document, will be applied to work on upgrades to the ATLAS detector and to the execution of other parts of the Operations Program, as deemed useful and appropriate. In general, the work on M&O will follow from the detector components that the U.S. delivers to ATLAS. A detailed Work Breakdown Structure (WBS) has been prepared for pre-operations, M&O, Upgrade R&D and Physics Support and Computing.

All work required for the successful conduct of the U.S. ATLAS Operations Program is organized into a WBS. The WBS completely defines the scope of work, the deliverables, and is the basis for planning, cost and schedule estimates, and measurement of performance. The current WBS can be found at this URL: <http://www.usatlas.bnl.gov/RPMP/USATLAS-WBS-Feb%202012.pdf> and will be expanded to a level sufficient to allow definition of individual tasks/elements for which costs can be estimated.

Cost estimates will be generated at the most detailed level of the WBS and summed to the top level to determine the total cost of the U.S. ATLAS Operations Program. Schedules with milestones are established. Interdependencies (project logic) will be defined between the WBS elements to generate detailed schedules for each task. The analysis of completed milestones and costs provides a method for measuring performance.

4.2 Schedules and Milestones

Schedules for the U.S. ATLAS Operations Program will be generated based on the WBS.

4.2.1 Schedules

The detailed schedules will be generated by each Subsystem Manager to show milestones and resources for all efforts associated with work required to be provided for that subsystem. Activity duration, start and completion dates are coordinated with the overall ATLAS schedule activities. These U.S. ATLAS activities are logically interconnected to form networks with all other elements that comprise the subsystem. These schedules are maintained by the Subsystem Managers and are kept consistent with the current cost estimate. The detailed schedules from each subsystem will be used to generate the summary schedules that are used for estimating the schedule and costs.

4.2.2 Summary Schedule

Key U.S. ATLAS milestones and other selected milestones from the schedules are incorporated into a summary milestone schedule that is used for reporting purposes. This summary schedule addresses all subsystems and provides an overview of work in process. These schedules are updated on the basis of status inputs and used for periodic reporting. Whenever possible we use ATLAS milestones.

4.3 Prioritization of Different Parts of the Operations Program

Acting on the basis of the yearly funding guidance from the U.S. LHC OPO, the Operations Program Manager sets target budgets for each Level 2 component of the Operations Program including M&O, Physics Support and Computing, and Upgrade R&D. Priority may have to be placed on one of these areas, depending on the level of the guidance and the needs of the experiment. Advice on the allocations and priorities will be given by the EC each June. Allocations at the beginning of the next fiscal year will be established by the Management Board by August. These are reported to the Level 2 Managers, the EC and the IB.

4.4 Performance

The management of funds at the level of support given by DOE and NSF is done in accordance with the estimated needs of the U.S. ATLAS Operations Program. Work authorization is provided for each U.S. institution through a yearly Institutional MOU process. Standard accounting procedures are used

to collect costs for completed work and to define the funds available for the remainder of the fiscal year. A status report is to be issued each quarter, as shown in Table 4-1.

Table 4-1. Periodic Reports to DOE and NSF

REPORT	FREQUENCY	SOURCE	RECIPIENTS
Operations Program Status	Quarterly	U.S. ATLAS Collaboration	U.S. LHC Operations Program Office BNL Designated Laboratory Official, Executive Committee, DCAP Institutional Representatives

4.5 Reporting

4.5.1 Technical Progress

The individual responsible for each activity at each institution will report the progress in each quarter. Each item should refer to the appropriate Level 3 WBS element and any completed milestones. This is due on the 5th of the month following the end of the quarter and is to be sent to the Subsystem Manager. Each level 2 Manager collects the input and enters a summary by the 15th of the month. The Manager for Physics Support and Computing, the M&O Manager and Upgrade R&D Manager write a summary of the activities for those areas. The Operations Program Manager collects the whole report and writes an overall assessment and summary, and finishes the report by the 25th of the month following the end of the quarter.

4.5.2 Costs

Cost estimates will be prepared by the Managers using the WBS. All estimates will include all non-scientific labor, materials and supplies (M&S) and travel required to complete the work comprising the U.S. ATLAS Operations Program and will be specified in MOUs and yearly updates. Costs will be broken down according to whether they are supported by the Operations Program or the core institutional programs. A Management Reserve will be controlled by the Operations Program Manager. Escalation will be based on the latest DOE guidance.

Each institution reports on each active WBS item. Reports are provided to the U.S. ATLAS Operations Program Office.

4.5.3 Procurements

The U.S. ATLAS Operations Program has defined procurements over \$100k as major and subject to U.S. ATLAS Operations Program Office tracking and control. U.S. ATLAS will work closely with the ATLAS Technical or Operations Coordinator in making sure that proper design reviews are conducted. The U.S. ATLAS Operations Program Manager must approve major procurements and the U.S. LHC Program Manager must be notified at least two days prior to the award of a contract larger than \$1,000,000.

4.6 Change Control

4.6.1 Cost and Schedule

To take into account uncertainties in cost estimates a Management Reserve (MR) is maintained. Management Reserve funds are held by the U.S. ATLAS Operations Program Manager.

The Change Control Process outlined in Table 4-2 is used to allocate Management Reserve funds and control changes to Technical Scope, Costs or Schedules. The membership of the Change Control Board (CCB) consists of the Management Board chaired by the OPM.

Operations Program Change Proposals (OPCP) for changes to the Technical Scope, Cost or Schedule are referred to the CCB. The following changes are required to be submitted for consideration by the CCB:

- Any change that affects the interaction between different detector systems, the interaction region, or hall safety issues. Such changes also require the concurrence of international ATLAS.
- Any change as indicated in Table 4-3 that alters the scope, the cost or schedule as defined in major Agency Reviews of the Operations Program.
- Any change to the budget of the Management Reserve.

After the CCB recommends action on the OPCP, the OPM approves or rejects the OPCP. The BNL DLO is also required to approve all OPCPs involving a technical, cost or schedule change. The ATLAS Spokesperson as a courtesy will be notified of all changes for planning purposes. The U.S. LHC Operations Program Office must also approve any changes over \$50k. Upon approval, the change is incorporated into a log. An audit trail is provided for each change.

Table 4-2. U.S. ATLAS Change Control Process

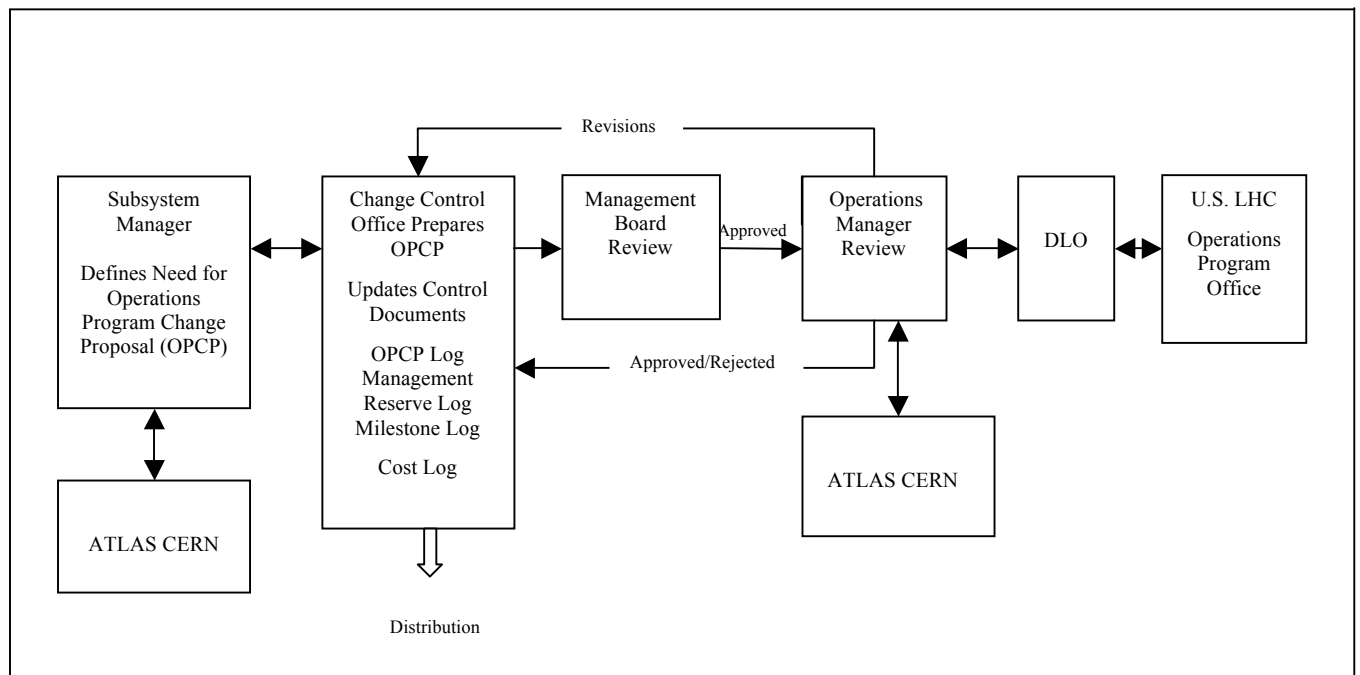


Table 4-3. U.S. ATLAS Change Control Thresholds

Level 3 U.S. ATLAS Operations Program Manager and BNL DLO	
Technical	Changes in scope.
Cost	Changes to the cost at WBS Level 2 compared to budgets presented to the previous agency review. The U.S. LHC Operations Program Office Manager must approve any changes over \$50k.
Schedule	Greater than a 3 month change in a high level milestone.

4.6.2 Program Management Plan

After its adoption, this Operations Program Management Plan will be reviewed yearly by the Operations Program Manager and the other Managers as part of the preparation for reviews by the DCAP. Proposals for its modification may be initiated by the OPM, the Executive Committee, the BNL DLO, or the funding agencies. Changes to the plan require approval of the U.S. LHC Operations Program Office and Joint Oversight Group. Modifications of the Operations Program Management Plan will require approval of the OPM, the BNL DLO, the U.S. LHC Program Manager, and the Joint Oversight Group.

4.7 Meetings with DOE and NSF

There are regular coordination meetings among the DOE/NSF U.S. LHC Operations Program Management, the Joint Oversight Group, the DLO, and U.S. ATLAS Operations Program Management personnel for problem identification, discussion of issues, and development of solutions. Written reports on the status of the U.S. ATLAS Operations Program are submitted regularly, as specified in Table 4-1.

Informal meetings between the OPM, DOPM and the U.S. LHC Operations Program Managers are held approximately every two weeks to discuss any issues that could affect the U.S. ATLAS Operations Program.

4.8 Periodic Reviews

Peer reviews, both internal and external to the Collaboration, provide a critical perspective and important means of validating designs, plans, concepts, and progress. The Detector and Computing Advisory Panel, appointed by the BNL DLO, provides a major mechanism for review (see Section 5.1). The U.S. LHC Operations Program Office conducts separate reviews of the U.S. ATLAS Operations Program. In addition, the OPM conducts internal reviews to provide technical assessments of U.S. ATLAS activities, as deemed appropriate. Normally, reports from reviews are made available to members of the U.S. ATLAS Collaboration. However, if a particular report contains material that is too sensitive for general dissemination, it may be deleted and replaced by a summary for the benefit of the Collaboration.

In addition to the day-to-day interaction of the line managers, there are major mechanisms for periodic formal assessment of the U.S. ATLAS Operations Program. These mechanisms include meetings of the JOG or periodic peer-reviews and evaluations conducted at the request of the U.S.

LHC Operations Program Office, the host laboratory and through any internal reviews conducted by laboratory and university program managers.

In particular, regular reviews are conducted by the U.S. LHC Operations Program Office of both the U.S. LHC Detector Maintenance & Operations and the U.S. LHC Software & Computing elements. The committee that carries out these annual reviews consists of outside consultants who are experts in maintenance and operations of particle detectors and computer systems. They evaluate the scope and costs and report to the U.S. LHC Operations Program Office.

5 EXTERNAL INTERACTIONS

5.1 ATLAS International

5.1.1 Management Interactions

The U.S. ATLAS Collaboration works within the international ATLAS Collaboration. The management structure of the international collaboration is described in Appendix 8. In this section we describe how the U.S. ATLAS Collaboration interacts with the overall ATLAS management.

The U.S. ATLAS management must operate within the regulations imposed by the U.S. funding agencies, the funding appropriated by the U.S. Congress, and the terms of the U.S.-CERN Protocol on LHC Experiments. Subject to these limitations, it is expected that the U.S. ATLAS management implements all decisions taken by the ATLAS Resource Review Board (RRB) and the international ATLAS Collaboration Board. The RRB comprises representatives from all ATLAS funding agencies and the management of CERN. The U.S. has DOE and NSF representatives. The RRB meets twice per year, usually in April and October. With regard to oversight of the ATLAS M&O costs, the RRB is assisted by a CERN Scrutiny Group, the role of which is to analyze critically the M&O reports and estimates made by the Collaboration, refine estimates in consultation with the Collaboration and advise the RRB on any course of action. The Scrutiny Group is appointed by CERN management and includes representatives from Member States and Non-Member States; at the present time it includes a U.S. representative.

ATLAS has adopted procedures for quality control and change requests valid for all Collaboration partners. For example, a Product Breakdown Structure (PBS/WBS) has been established and a global Engineering Data Management System (EDMS) is used to manage documents pertaining to ATLAS Technical Coordination, the ATLAS Detector, General Facilities, Assembly and Test Areas and Offline Computing. A CERN Drawing Directory (CDD) is used to manage all drawings. It is understood that the U.S. institutions will use these management procedures and tools in the same way as other ATLAS institutions. Similar structures are expected to be used for any future upgrade projects for the ATLAS detector. The U.S. ATLAS Operations Program Manager may also require additional reporting and record keeping.

A second area of computing that U.S. ATLAS participates in is the Worldwide LHC Computing Grid Project (WLCG). The WLCG is a project that is central to all four LHC experiments and is intended to provide the computing infrastructure required in common to LHC via the use of computational grids. The WLCG organization structure can be found at the following URL:

<https://espace.cern.ch/grid-interop/default.aspx>

We have U.S. ATLAS representatives on the Oversight Board, the Management Board, the Grid Deployment Board, the WLCG Collaboration Board, and currently on the Architect's Forum.

5.1.2 ATLAS Membership

The U.S. ATLAS Collaboration consists of physicists and engineers from U.S. institutions collaborating on the ATLAS experiment at the CERN LHC. A list of the participating institutions can be found at: http://www.usatlas.bnl.gov/USATLAS_TEST/institutes,%20reps,%20emails.htm.

Individuals from these institutions share responsibility for the construction and execution of the experiment with collaborators from the international high-energy physics community outside the U.S. Current institutional responsibilities are shown in Appendix 2. New U.S. institutions formally voted in as members of ATLAS become automatic members of U.S. ATLAS.

To become an author of ATLAS one must meet the following criteria:

- Have been an ATLAS member for at least one year.
- Not be an author of another major LHC collaboration at the time of application (this rule applies to all physicists, but an exception may be made for engineers).
- Have spent at least 80 working days and at least 50% of their available research time during the year doing ATLAS technical work (defined in the Appendix of the Authorship Policy document).

The total of 80 days technical work may be accumulated over more than one year in exceptional circumstances.

More information can be found on the ATLAS web page:

http://atlas.web.cern.ch/Atlas/GROUPS/GENERAL/SCINOTES/authorship_committee.html

While the current U.S. ATLAS physics program focuses on High Energy Physics and is supported by the HEP and EPP divisions of DOE and NSF, ATLAS will participate in heavy ion collisions.

5.2 U.S Funding Agencies

The Department of Energy and the National Science Foundation are the funding agencies for the U.S. participation in ATLAS Operations Program. As such the agencies determine the program scope, approve annual budgets, and monitor program implementation. The organization structure of DOE and NSF as it relates to the U.S. ATLAS Operations Program is shown in Appendix 6.

The DOE has delegated responsibility for the U.S. ATLAS activities to the Office of Science, Office of High Energy Physics. The NSF has delegated responsibility for U.S. ATLAS activities to the Division of Physics, Elementary Particle Physics Programs.

The U.S. ATLAS Operations Program receives substantial support from both DOE and NSF. Almost all the subsystems involve close collaboration between DOE and NSF supported groups. It is therefore essential that DOE and NSF oversight be closely coordinated. The DOE and NSF have established a U.S. LHC Joint Oversight Group (JOG) as the highest level of joint U.S. LHC Operations Program management oversight. This group is described in Section 1.4.

5.3 Core Research Program

The U.S. ATLAS Operations Program is not responsible for the core program activities of the U.S. ATLAS Collaboration. The Operations Program Manager and Deputy conduct an annual survey in which they interact with each U.S. ATLAS Collaborating institution and obtain demographic information about the institution personnel and activities on ATLAS.

6 SUPPORTING FUNCTIONS

6.1 Quality Assurance

The overall ATLAS Management has established a Quality Assurance Plan (QAP) at CERN to assure that the detector systems will achieve the technical requirements and reliability needed for operation at the LHC. A general description of the ATLAS QAP is given in ATLAS Document ATL-GE-CERN-QAP-0101.00. It assigns overall responsibility for this task to the ATLAS Spokesperson, assisted by the Technical Coordinator. Furthermore, each ATLAS System Leader (SL) is assigned the responsibility of implementing a Quality Assurance Plan relevant to that subsystem. Each SL is

expected to designate a Quality Assurance Representative (QAR) with the authority and organizational freedom to identify potential and actual problems that could result in a degradation of quality, to recommend corrective actions and to verify implementation of solutions.

Quality Assurance is an integral part of the U.S. ATLAS Operations Program. The U.S. ATLAS Operations Program Manager has overall responsibility for quality assurance. In general, the U.S. ATLAS Subsystem Managers have the quality assurance responsibilities for their subsystems including the following aspects of quality control:

- Identification of those areas, concepts and components that require in-depth studies, prototyping and testing.
- Incorporation of necessary acceptance tests into plans and specifications.
- Verification of system performance.
- Documentation of procedures and test results for fabrication and procurement phases.

6.2 Environment, Safety & Health

International ATLAS Management has established an ES&H program at CERN to assure that the delivered detector systems conform to safety standards in force at CERN for LHC operations. This program meshes with the policies of the CERN Safety Commission. Specifically, work in ATLAS follows a Work Package procedure where the leader of a given Work Package not only plans the work, but also identifies the risks and methods of mitigating any risks. The leader of a given Work Package is responsible for specifying any necessary training required by individuals doing particular work and also the leader is responsible for ensuring that those individuals complete any required training. The U.S. ATLAS Operations Program Manager has overall responsibility for ensuring that members of the systems comprising part of the U.S. ATLAS Operations Program work with the ATLAS Group Leader in Matters of Safety (GLIMOS) and satisfy all ATLAS-specified safety regulations and that all institutional ES&H requirements are fully met for U.S. ATLAS work performed in any U.S. institutions.

In December 2006 ATLAS adopted a notification procedure for the case of a serious accident determined by the ATLAS management where the Institutional Representative from every institution in the world will be kept informed about the details of such an incident and any follow-up. In turn, the U.S. ATLAS Operations Program Manager and/or Deputy will inform the Director and/or the Head of ES&H at the host lab, BNL, as well as LHC Program Manager and Deputy in the DOE and NSF. The U.S. Operations Program Manager and Deputy will follow-up any issues raised by any incident.

6.3 Property Management

All property will be managed in accordance with established practices of the participating U.S. ATLAS institutions. Property transferred to CERN will be subject to provisions of the International Agreement.

7 LIST OF ABBREVIATIONS

ALD	BNL Associate Laboratory Director for Nuclear and Particle Physics
APS	American Physical Society
ASG	Analysis Support Group
ASM	Analysis Support Manager
BNL	Brookhaven National Laboratory
CB	ATLAS Collaboration Board
CCB	Change Control Board
CDD	CERN Drawing Directory
CERN	European Laboratory for Particle Physics
CMB	Computing Management Board
C-RRB	Computing Resources Review Board
DCAP	Detector and Computing Advisory Panel
DLO	Designated Laboratory Official
DOE	Department of Energy
DOPM	Deputy Operations Program Manager
DPSCM	Deputy Physics Support and Computing Manager
EC	Executive Committee
EDMS	Engineering Data Management System
EPP	Elementary Particle Physics
ES&H	Environmental Safety and Health
GLIMOS	ATLAS Group Leader in Matters of Safety
HEP	DOE Headquarters Office of High Energy Physics
HEPAP	High Energy Physics Advisory Panel
IB	Institutional Board
ICB	International Computing Board
IMOU	Institutional MOU (between U.S. ATLAS Operations Program Office and an Institution)
IT	Information Technology
JOG	Joint Oversight Group
L2	WBS Level 2, e.g. 2.2
LHC	Large Hadron Collider
LHCC	CERN LHC Committee
M&O	Maintenance and Operations
M&S	Materials and Supplies

MOU	Memorandum of Understanding
MR	Management Reserve
NCP	National Contact Physicists
NSF	National Science Foundation
OP	Operations Program
OPCP	Operations Program Change Proposal
OPM	U.S. ATLAS Operations Program Manager
OPMP	Operations Program Management Plan
OPO	Operations Program Office
OSG	Open Science Grid
PBS	Product Breakdown Structure
POB	Project Oversight Board (for computing)
PSCM	Physics Support and Computing Manager
QAP	Quality Assurance Plan
QAR	Quality Assurance Representative
R&D	Research and Development
RRB	ATLAS Resource Review Board
S&C	Physics Analysis Support and Computing
SC	DOE Office of Science
SG	Scrutiny Group
SL	ATLAS System Leader
SM	Software Manager
SPMB	Software Project Management Board
TDR	Technical Design Report
TRT	Transition Radiation Tracker
USM	Upgrade Subsystem Manager
WBS	Work Breakdown Structure
WLCG	Worldwide LHC Computing Grid

REFERENCES

1. U.S. LHC Construction Project Execution Plan, Rev. 1, October, 2002.
2. U.S. LHC Construction Project Execution Plan, Rev. 1, October, 2002, Appendix A.

APPENDIX 1

Letter to Dr. John Marburger from the Joint Oversight Group Fall, 2000



*U.S. Department of Energy
and the
National Science Foundation*



JOINT OVERSIGHT GROUP

NOV 21 2000

Dr. John Marburger
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P.O. Box 5000
Upton, New York 11973-5000

Dear Dr. Marburger:

The U.S. Department of Energy (DOE) and the National Science Foundation (NSF) are supporting construction of the Large Hadron Collider (LHC) at the European Center for Particle Physics (CERN) under the terms of the International Agreement between CERN and the U.S. with its protocols and the interagency Memorandum of Understanding of December, 1999. Under that Agreement the U.S. ATLAS Construction Project has been managed by Brookhaven National Laboratory (BNL) as Host Laboratory. Brookhaven National Laboratory, as the Host Laboratory, has provided the central management to oversee and coordinate project activities and reporting, in addition to providing specific elements of the project as a collaborating institution.

The International Agreement provides that, beyond the LHC Construction Project, U.S. scientists will participate as full partners in the LHC Research Program. The DOE and the NSF are now considering the elements necessary for successful U.S. participation in the Research Program, including both the pre-operational and operational phases. The first elements of that participation are in place, namely the designation of BNL and Fermilab as Host Laboratories, respectively, for the U.S. ATLAS and U.S. CMS Research Programs. The Host Laboratories, in partnership with the U.S. ATLAS and CMS collaborations, have already made substantial progress in organizing and implementing the U.S. LHC Software and Computing Project. In particular, the management structures are in place, Project Management Plans have been drafted, and software development and Tier 1 computing centers have been initiated. A baseline review of the Project is scheduled for November 2000.

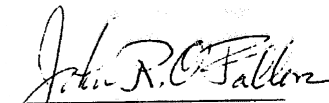
Another major component of the U.S. LHC Research Program, pre-operational and operational support of U.S. participation in the ATLAS and CMS detectors beyond base support, must now be put in place. You have agreed to be Host Laboratory for the U.S. ATLAS Research Program. In that capacity we now request that you initiate planning and assume management oversight for the pre-operational and operational phases of the U.S. ATLAS Research Program. This management oversight includes the development of annual budget requests, and the preparation, in concert with the U.S. ATLAS Collaboration, of a Management Plan for Pre-operations and Operations. The draft Plan should be submitted to the DOE/NSF Joint Oversight Group for approval.

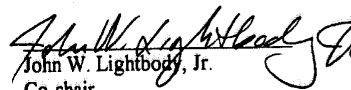
Plans to be developed with the appropriate leadership at CERN could be expected to include:

- Participation in detector operations and data monitoring;
- Support for monitoring and maintenance of U.S.-provided subsystems;
- Establishment of an environment at BNL including a virtual control room to facilitate U.S.-based ATLAS physics analysis; and,
- Continuing R&D, with possible fabrication, of upgrades to enhance the physics productivity of the detector.

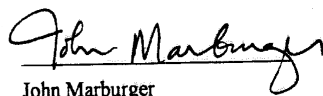
This document further specifies the responsibilities agreed upon in the Host Laboratory letter of August 1999. Funding will be identified to carry out the U.S. ATLAS Research Program, including both U.S. Software and Computing, and Pre-operations and Operations. We expect that the methods for allocating the designated funding will be similar to those used for the U.S. ATLAS Construction Project. The methods of allocation should be specified in the Project Management Plan.

Sincerely,


John R. O'Fallon
Co-chair
U.S. LHC Joint Oversight Group
Department of Energy


John W. Lightbody, Jr.
Co-chair
U.S. LHC Joint Oversight Group
National Science Foundation

On behalf of Brookhaven National Laboratory, I accept this further specification of the Host Laboratory role for the U.S. ATLAS Research Program.


John Marburger
Director
Brookhaven National Laboratory

APPENDIX 2

Current Institutional Responsibilities

Subsystem	Institutions
Silicon	UC-Berkeley/LBNL, Columbia, UC-Santa Cruz, Iowa State, Iowa, Louisiana Tech, New Mexico, Ohio State, Oklahoma, SLAC, UT Dallas, Wisconsin
TRT	Duke, Hampton, Indiana, Pennsylvania, Yale
Liquid Argon Calorimeter	Arizona, BNL, Columbia, Pittsburgh, Southern Methodist U., SUNY-Stony Brook
Tile Calorimeter	ANL, Chicago, University of Illinois at Urbana-Champaign, Northern Illinois University, Michigan State, SLAC, UT-Arlington
Muon Spectrometer	Arizona, Boston, BNL, Brandeis, Duke, Harvard, University of Illinois at Urbana-Champaign, Massachusetts-Amherst, MIT, Michigan, SUNY-Stony Brook, SLAC, South Carolina, Tufts, UC-Irvine, Washington
Trigger and DAQ	ANL, BNL, UC-Irvine, Michigan State, Oregon, SLAC, Wisconsin, UT Arlington, NYU
Software	Arizona, ANL, Boston, BNL, Chicago, Duke, Harvard, Indiana, Iowa State, LBNL, Massachusetts-Amherst, Pittsburgh, SMU, UT-Arlington
Facilities	Boston, BNL, Chicago, Harvard, Langston, New Mexico, Indiana, Michigan, Michigan State, Oklahoma, SLAC, UT-Arlington
Upgrade R&D	BNL, Columbia, Hampton, UC-Berkley/LBNL, New Mexico, NYU, Ohio State, Oklahoma, Oklahoma State, Pennsylvania, SUNY-Stony Brook, UC-Santa Cruz, Southern Methodist University, Yale

APPENDIX 3

Letter to Dr. Praveen Chaudhari from the Joint Oversight Group. November 7, 2003

Official 2003-2



**U.S. Department of Energy
and the
National Science Foundation**



November 7, 2003

Joint Oversight Group

Dr. Praveen Chaudhari
Director
Brookhaven National Laboratory
Building 460
Upton, NY 11973-5000

Dear Dr. Chaudhari:

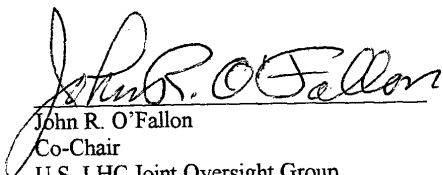
At its recent meeting the Joint Oversight Group (JOG) decided to augment the management structure for the U.S. ATLAS and U.S. CMS Programs by creating a Deputy Program Manager position for both programs. This letter defines a process for making this a reality.

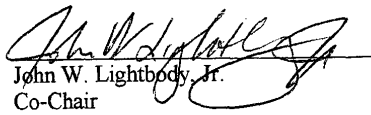
This management structure is consistent with the original expectations of line management through the Host Laboratories and the Program Managers appointed by the Host Laboratories. Program Management responsibilities include the on-going detector construction projects and the elements of the research program: detector Maintenance & Operations (M&O) and Software & Computing (S&C). The addition of a Deputy Program Manager position is in direct response to this broad scope of responsibility and the desire to provide additional opportunities for empowering universities in leadership positions. Regarding the Program Manager and Deputy Program Manager, it is anticipated that one be from a National Laboratory and the other from a U.S. university. It is expected that in each U.S. detector program either the Program Manager or the Deputy Program Manager, whichever is from a university, will also serve as the Principal Investigator for the NSF Cooperative Agreement covering the research program funding. The NSF Principal Investigators will be responsible for ensuring that NSF research program funds are allocated in accordance with the decisions made by the Program Managers.

When identifying appropriate candidates for the Program or Deputy Program Manager positions it is expected that the Host Laboratories and/or Program Managers will solicit active involvement, support and concurrence by the U.S. collaborations and communicate progress along the way to the agencies. This should be followed by requests from the Host Laboratories for concurrence by the JOG and finally appointments by the Host Laboratories. Management documents should be revised to reflect this new structure along with descriptions of the roles and responsibilities of the Program Managers and Deputy Program Managers. We expect the Host Laboratories to provide primary oversight on issues that may arise with the implementation of this new management structure.

Implementing this Program/Deputy Program Management structure is an important step toward meeting the challenge and needs of the rapidly expanding U.S. LHC Research Program, overall. It is hoped that this structure also will reflect the diversity of the National Laboratory and University communities, as well as the Agencies, involved in these detector collaborations.

Sincerely,

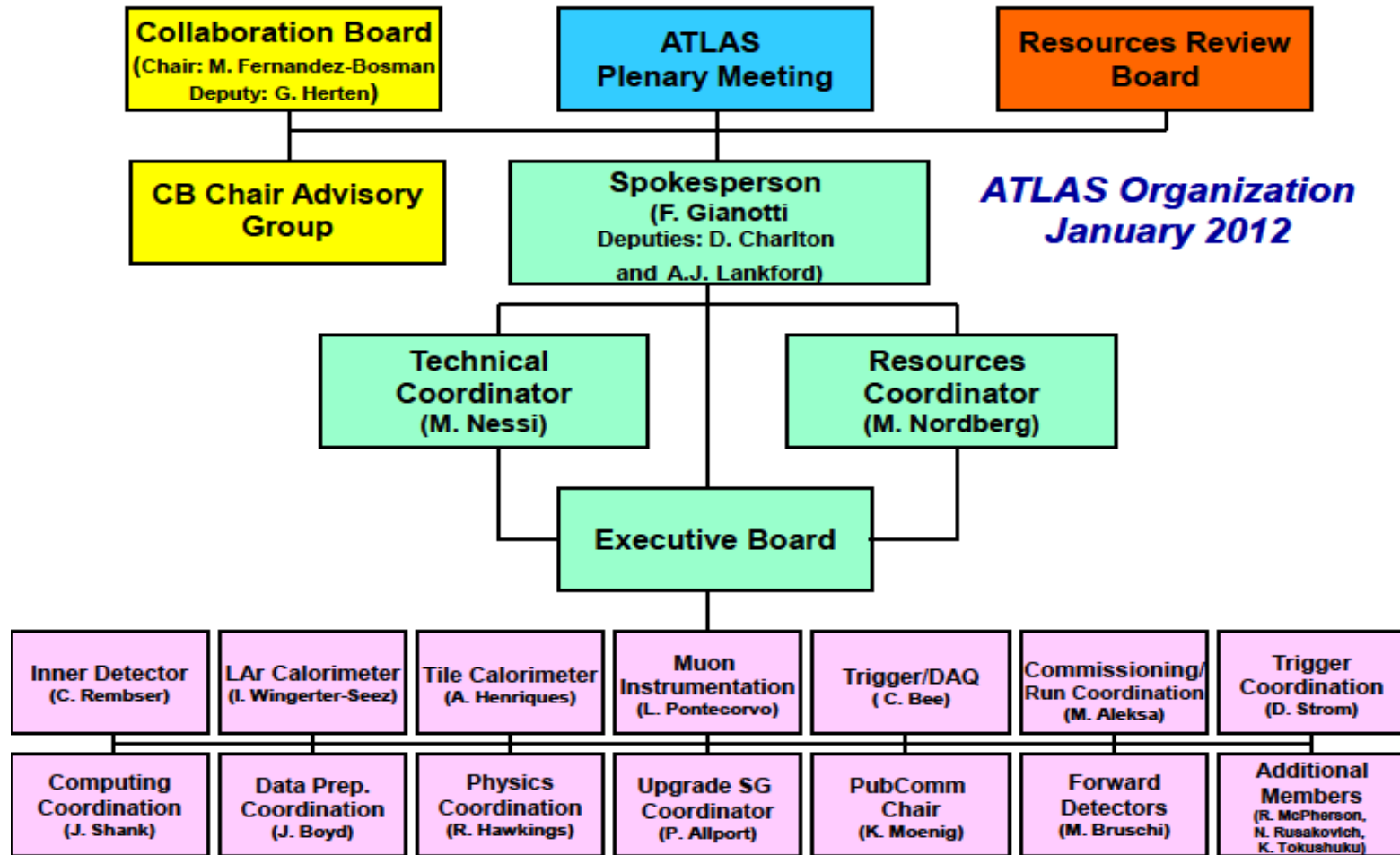

John R. O'Fallon
Co-Chair
U.S. LHC Joint Oversight Group
Department of Energy


John W. Lightbody, Jr.
Co-Chair
U.S. LHC Joint Oversight Group
National Science Foundation

Cc:
Robin Staffin, SC-20
John R. O'Fallon, SC-20
Jack Lightbody, NSF
Aesook Byon-Wagner, SC-20
Moishe Pripstein, SC-20
Marv Goldberg, NSF
Jim Whitmore, NSF
Pepin Carolan, FAO
Thomas Kirk, BNL
William Willis, Columbia University

APPENDIX 4

ATLAS Organization Chart



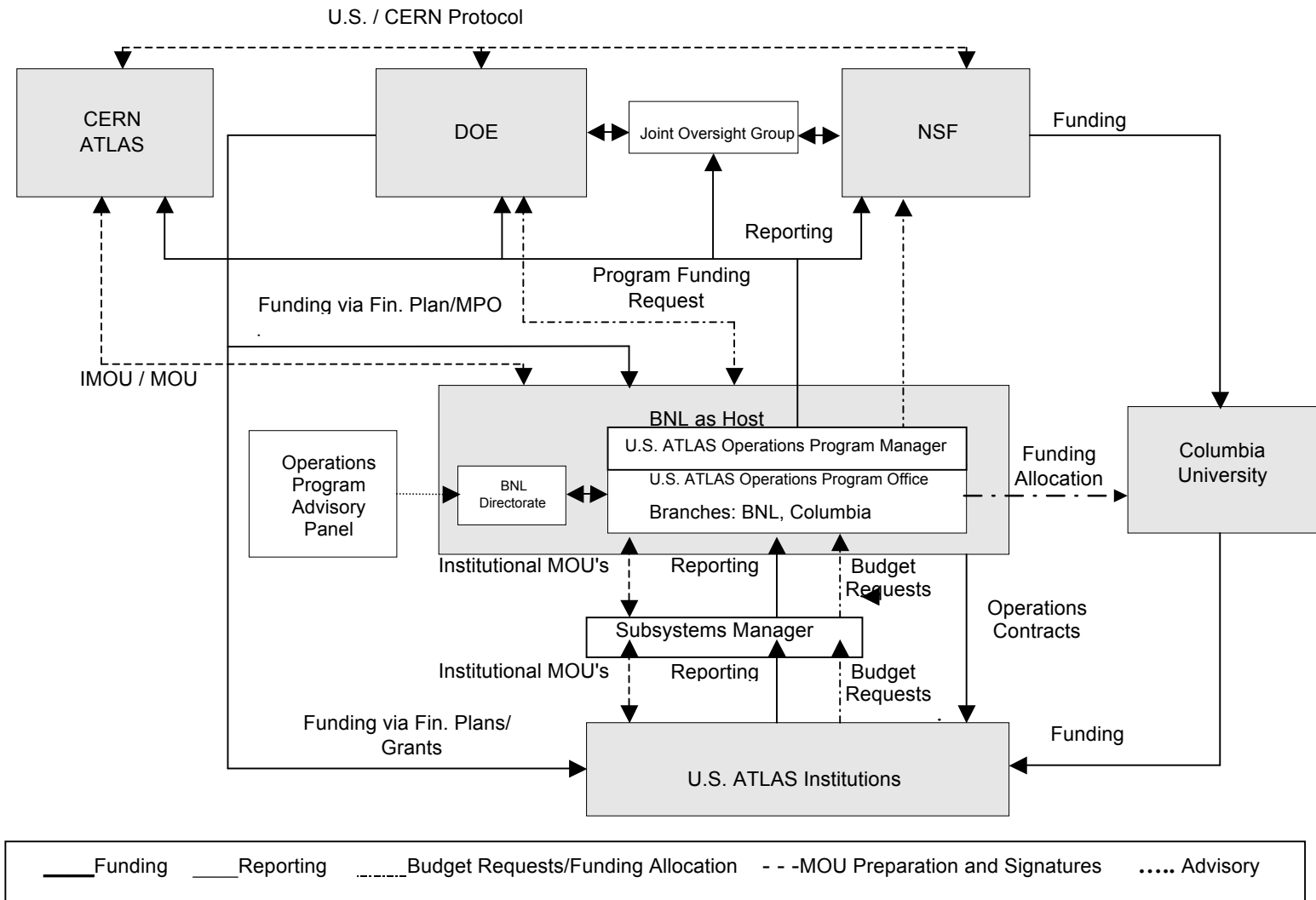
APPENDIX 5

U.S. ATLAS Appointments

WBS	Position	Acronym	Term(yrs)	Recommend Candidates	Who Appoints	Who Concurs
	Institutional Board Chair	IB Chair	3		Elected by IB	none
	Operations Program Manager	OPM	3	IB	DLO	JOG, IB
	Deputy Operations Manager	DOPM	3	IB	DLO	JOG, IB
2.0	Physics Support and Computing Manager	PSCM	2	IB	OPM	IB
2.0	Deputy Physics Support and Computing Manager	DPSCM	2	IB	OPM	IB
	Physics Advisor	PA	2	IB	OPM	PSCM, IB
2.2	Software Manager	SM	2		PSCM	OPM, IB
2.3	Facilities and Distributed Computing Manager	FDCM	2		PSCM	OPM, IB
2.4	Analysis Support Manager	ASM	1	IB	PSCM	OPM, IB
2.4	Deputy Analysis Support Manager	DASM	1	IB	PSCM	OPM, IB
3.0	M&O Manager	none	2	IB	OPM	IB
3.x	Subsystem Managers		2	IB members in each subsystem	M&O Manager	IB members in each subsystem, OPM
3.8	Education/Outreach Coordinator	none	2	IB	OPM	IB
4.0	Upgrade R&D Manager	none	2	IB	OPM	IB
4.x	Upgrade R&D Subsystem Managers		2	IB members in each subsystem	Upgrade R&D Manager	IB members in each subsystem, OPM
	At large members of Executive Committee	none	3		Elected by IB	

APPENDIX 6

MOU, Funding and Reporting Process



APPENDIX 7

U.S. ATLAS Operations Program Metrics

2.0 Physics Support and Computing

2.2 Software

- ❖ Number of FTEs and U.S. fraction of the total ATLAS FTEs recognized for Category A and B Core Software work

2.3 Facilities (Tier 1 and Tier 2 in each case)

- ❖ Meeting WLCG Pledge for CPU, Disk and Tape
- ❖ Availability according to the WLCG MOU (as measured by the ATLAS VO-specific SAM tests)
- ❖ Performance:
 - a) Analysis performance as to events analyzed/sec at 50% of the total capacity
 - b) Job failure rate (facility related)
 - c) Average WAN data transfer rate into and out of the Tier 1 and each Tier 2 center

2.4 Analysis Support

- ❖ Number and fraction of U.S. physicists giving internal talks at ATLAS Physics Meetings
- ❖ Number and fraction of U.S. authors of conference notes or publications

3.0 M&O

- ❖ U.S. Responsibilities
 - Fraction of LAr LVPS units working
 - Number dead completely
 - Number working without redundancy
 - Number of dead LAr FEB and fraction of total
 - Number of dead MDT CSM cards and fraction of total
- ❖ ATLAS Shared (20%) Responsibilities
 - Fraction of TileCal LVPS working
 - Fraction of TileCal Drawers working
 - DAQ Efficiencies
 - Overall down fraction & breakdown
 - Busy/Subsystem
 - Number of Si-TX failures and location

- ❖ Non-U.S. Responsibilities
 - Number of CAEN HVPS & LVPS that have expired
- ❖ ATLAS General
 - Loss of luminosity due to each subsystem
 - Fraction of working channels each subsystem

4.0 Upgrade R&D

- ❖ Fraction of designed number of modules deployed on a stave
- ❖ Number of ASICs submitted and successfully tested

General

- ❖ Operations Tasks: U.S. fraction of Category 1 (control room), 2 (monitoring) and 3 (expert)
- ❖ Once per year: Fraction of Category A and B M&O Payments made to ATLAS

APPENDIX 8

The International ATLAS Experiment and its Management

The large general-purpose LHC experiments rank among the most ambitious and challenging technical undertakings ever proposed by the international scientific community. The inter-regional collaborations assembled to design, implement and execute these experiments face unprecedented sociological challenges in marshalling their enormous, yet highly decentralized, human and economic resources. The overall ATLAS approach to this challenge is to base most of the ATLAS governance on the collaborating institutions rather than on any national blocks. Thus, the principal organizational entity (Appendix 4) in ATLAS is the Collaboration Board (CB), consisting of one voting representative from each collaborating institution, regardless of size or national origin. Affiliated members do not receive a separate vote.

The CB is the entity within ATLAS that must ratify all policy and technical decisions, and all appointments to official ATLAS positions. It is chaired by an elected Chairperson who serves for a non-renewable two-year term. The Deputy Chairperson, elected in the middle of the Chairperson's term, succeeds the Chairperson at the end of the term. The CB Chairperson appoints (and the CB ratifies) a smaller advisory group that can be consulted between ATLAS collaboration meetings.

Executive responsibility within ATLAS is carried by the Spokesperson who is elected by the CB for a maximum two two-year terms. The Spokesperson is empowered to nominate one or two deputies to serve for the duration of the Spokesperson's term in office. The Spokesperson represents the ATLAS Collaboration in all its external activities. The ATLAS spokesperson is typically assisted by two deputies appointed by the spokesperson with the concurrence of the Collaboration Board.

The ATLAS central management team presently includes Technical and Resource Coordinators, both CERN staff members whose appointments require CERN management approval. The Technical Coordinator has overall responsibility for technical aspects of detector construction. This includes responsibility for integration of ATLAS subsystems and for coordinating with the CERN infrastructure, including the installation of the experiment at surface and underground areas. The Resource Coordinator is responsible for the budget and human resources, including securing Common Fund resources, and negotiating the MOUs with funding agencies. This management structure has evolved to meet the needs of the Operations Program. The management team for a newly elected Spokesperson is ratified by the CB.

The ATLAS Spokesperson presently chairs an Executive Board (EB), consisting of representatives from the major detector subsystems, the Technical, Resource, Computing, Physics, Run, Trigger, Data Preparation, Upgrade Steering Group, Publication Committee Chair, and two at-large members. The CB Chairperson and Deputy Chairperson are ex-officio. Computing Coordination involves the Computing Coordinator and the Software Project Leader. The Executive Board advises the execution of the ATLAS experiment according to the policies established by the Collaboration Board and meets monthly with an open session and a closed session.

There is also a Technical Management Board (TMB) chaired by the Technical Coordinator that meets monthly. The Technical Coordinator oversees the TMB that reviews technical and scheduling issues related to the operations of the detector.

Each ATLAS subsystem has a Project Leader responsible for ensuring that the design, construction, installation and commissioning of the corresponding subsystem is carried out on schedule, within the cost ceiling, and in a way that guarantees the required performance and reliability. Each major ATLAS

subsystem is overseen by a technically-oriented Steering Group, with expertise in all the relevant technical areas. Each physics analysis and performance group is lead by a Physics Coordinator.

To manage the strategic mission of the ATLAS research program the computing and physics analysis recourses are centrally organized. In this section, we give a brief description of the main elements.

The organization of ATLAS Computing is illustrated in the chart found at the URL:

<https://twiki.cern.ch/twiki/bin/view/Atlas/ComputingOrganization>

The top level of management of ATLAS Computing, which reports to the ATLAS EB, consists of the Computing Coordinator. This position has two-year terms, and is filled by the Spokesperson following a nomination process and subsequent approval by the Collaboration Board. The highest level of oversight for computing is left to the Trigger Offline Board (TOB), which consists of the ATLAS Spokesperson, Deputy Spokesperson, Physics Coordinator, Computing Coordinator and Software Project Manager. The Computing Coordinator is advised by the International Computing Board (ICB). The International Computing Board is chaired by a member nominated and elected by the Board, with the approval of the Spokesperson. The ICB consists of one member from each funding agency associated with resources employed by ATLAS Computing. This usually amounts to one member/country, but for the U.S, there is one for NSF and one for DOE., and has the purpose of refining and approving the computing model, gathering and assigning resources and acting as an interface between ATLAS Computing and the national funding agencies. Ultimately, computing resources specific to ATLAS are reviewed in the ATLAS Resources Review Board (RRB).

A Computing Management Board (CMB) reports to the Computing Coordinator. The CMB consists of members who act as liaisons in several domains that affect ATLAS Computing: the ICB Chair, a liaison for the Trigger and Data Acquisition subsystem, a liaison to Physics Coordination, Commissioning, Data Model, Data Management, Grid and Data Challenge Coordinators and the Planning and Resources Organizer. The Software Project Manager works with the Architecture Team (A-Team) to build, document, and maintain the primary software services required by ATLAS Computing. Subsystem-specific software, such as detector simulation and reconstruction, are the responsibilities of the detector subsystems, but require liaisons from each of the subsystems to the Software Project Manager. In addition to the subsystem-specific software, there are areas that are coordinated by the Software Project Manager: Simulation, Core Services, Infrastructure (e.g., code management), Calibration/Alignment, Event Selection and a liaison to the Data Management. Each of these areas has a person reporting to the Software Project Manager. Taken together, the responsible parties form the Software Project Management Board (SPMB).

The Worldwide LHC Computing Grid (WLCG) is a project that is central to all four LHC experiments and is intended to provide the computing infrastructure required in common to LHC via the use of computational grids. The WLCG organization structure can be found at the following URL:

<https://espace.cern.ch/grid-interop/default.aspx>

Resources specific to WLCG are reviewed by the Computing Resources Review Board (C-RRB). High level oversight of the WLCG is undertaken by the Project Oversight Board (POB), which consists of one member from each nation contributing significant resources to LHC Computing, the WLCG Project Manager, a representative of CERN management, the Director of the Information Technology Division (IT) at CERN, a recording secretary, and the computing coordinator from each of the four experiments. The U.S. has influence and presence on a number of boards which control the WLCG. These include the

Collaboration Board and the Grid Deployment Board. There is also representation from the Open Science Grid on WLCG management boards.