

# **ASTROPHYSICAL RESEARCH CONSORTIUM**

## **Principles of Operation for SDSS-IV**

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### **1 Introduction**

Over the past 15 years, the Sloan Digital Sky Survey has carried out some of the most influential surveys in the history of astronomy. Through three prior epochs, called SDSS-I, II, and III, the SDSS has provided world-leading data sets for a vast range of astrophysical research, including the study of extragalactic astrophysics, cosmology, the Milky Way, and stars. The current SDSS-III project is funded to operate through June 30, 2014. Even thereafter, the Sloan Foundation 2.5-m Telescope and its instruments will remain a world-leading facility for wide-field spectroscopy, ready to pursue further state-of-the-art investigations of the Universe.

SDSS-IV as currently envisaged is a six-year program to use the Sloan Foundation 2.5-meter Telescope at Apache Point Observatory to carry out three surveys (APOGEE-2, eBOSS, and MaNGA) on three scientific themes: the structure, dynamics, and chemical evolution of the Milky Way galaxy; dark energy and cosmological parameters; and the dynamics and structure of nearby galaxies from spatially resolved spectroscopy. eBOSS includes two major subprograms, TDSS and SPIDERS, focused on the follow-up of variable sources and X-ray sources, respectively. APOGEE-2 also includes a southern component to be carried out on the du Pont 2.5-meter telescope at Las Campanas Observatory. Observations are planned to take place between 1 July 2014 and 30 June 2020.

This document defines the scientific objectives, management structure, and basic operational policies for the project.

SDSS-IV builds upon the scientific and technical success of the first three phases of the Sloan Digital Sky Survey (SDSS-I, SDSS-II and SDSS-III), which have thus far used the 2.5-meter telescope to carry out imaging of over 14,000 deg<sup>2</sup> and spectroscopy of 2.6 million stars, galaxies and quasars. However, SDSS-IV is a distinct project; policies and data rights from previous SDSS projects do not carry over to SDSS-IV unless explicitly stated in this document.

The principles articulated here have been agreed upon by the Participating Institutions. They may be revised as needed by future agreements. Changes to the PoO must be approved by the ARC Board of Governors, based on recommendations from the Advisory Council.

## 1.1 Scope

This document provides the basis for the governance of the SDSS-IV collaboration. The Director of SDSS-IV will develop and implement more specific procedures and rules in many of the following areas in keeping with the principles expressed here. The Director will keep the Advisory Council informed about such procedures and rules, which will be posted to the SDSS-IV internal website.

## 1.2 Key Terms

Certain key terms, when capitalized, will have the following meanings throughout this document:

- **SDSS-I:** The SDSS-I, originally the SDSS, is defined to consist of all operations and data obtained prior to 1 July 2005 with the Sloan Foundation 2.5-meter Telescope.
- **SDSS-II:** The SDSS-II is defined to consist of all operations and data obtained between 1 July 2005 and 30 June 2008 with the Sloan Foundation 2.5-meter Telescope.
- **SDSS-III:** The SDSS-III is defined to consist of all operations and data obtained between 1 July 2008 and 30 June 2014 with the Sloan Foundation 2.5-meter Telescope.
- **Advisory Council (AC):** The body which represents the Participating Institutions and advises the ARC Board on matters relating to SDSS-IV. Until the AC is established, the Steering Committee (SC) will act in its place.
- **ARC:** Astrophysical Research Consortium, a non-profit Washington corporation for research and education in astronomy with the following current institutional membership (as of June 2012): *University of Washington, University of Chicago, Johns Hopkins University, Princeton University, Institute for Advanced Study, New Mexico State University, University of Colorado, and University of Virginia*. ARC has ultimate responsibility for SDSS-IV. The ARC Board of Governors (or ARC Board) consists of two representatives from each of ARC's member institutions.
- **Architects:** Team members who, on the basis of a significant contribution to the design, construction, execution, or management of SDSS-IV, are awarded authorship rights on papers involving proprietary SDSS-IV data. Architect status does not grant rights to continued access to SDSS-IV data.
- **Collaboration:** Collectively, all Participating Institutions and Participants.
- **Core Programs:** The APOGEE-2, eBOSS (including TDSS and SPIDERS), and MaNGA surveys, collectively.
- **Director:** The Director of SDSS-IV.
- **External Collaborator:** A non-Participant who is granted access to SDSS-IV data and/or co-authorship on an SDSS-IV paper in order to assist with a specific project.
- **External Participant:** A scientist at a non-Participating institution who is granted full rights for data access and science participation on the basis of substantial contributions

to SDSS-IV infrastructure and project deliverables.

- **Management Committee:** The group that provides advice on regular operations of the project to the Director and the Central Project Office.
- **Ombudsperson:** The Ombudsperson is an independent, neutral party who helps settle disagreements within the project in an informal manner.
- **Participants:** Long-term scientific staff, e.g. faculty, research-track scientists, and the equivalent, who have access to the SDSS-IV Science Archive and rights for scientific exploitation and publication of SDSS-IV data prior to public release. The extent of Participant status within each Participating Institution is described in the respective MOU.
- **Participating Institutions:** The institutions participating in SDSS-IV. There are two categories of participation: Full and Associate. Full members and Associate members with at least three Participants have voting rights on the Advisory Council. Rights and responsibilities of each institutional member of the collaboration will be governed by an individual Memorandum of Understanding (MOU).
- **Principles of Operation:** Principles of Operation, this document, setting forth the operating principles for SDSS-IV. These are understood to be distinct from the principles that governed SDSS-I, SDSS-II and SDSS-III.
- **Science Archive:** the repository of all scientifically useful SDSS-IV data made accessible to Participants.
- **Scientific and Technical Requirements:** A document, drawn up by the Director and approved by the AC, that specifies the scientific performance and interface requirements of each instrument and software package used by the project.
- **Survey Teams:** The teams of people associated with each of the Core Programs.

## 2 Scientific Program

The intention of SDSS-IV is to conduct three interlocking surveys over a six-year period, with scientific goals as listed below.

- The APO Galactic Evolution Experiment 2 (APOGEE-2) will explore the formation and evolution of the Milky Way using a unique, global spectroscopic survey of *all* of its environments. Using near-infrared observations (around 1.6 microns) to peer through interstellar dust, from sites in both the Northern and Southern hemispheres, APOGEE will investigate the kinematics and chemistry of stars in the Milky Way disk, the stellar halo, and the Galactic bulge all on equal footing. The instrument at APO began operation in 2011 and will continue throughout SDSS-III; the APOGEE-2N program will continue those observations in the SDSS-IV era. The APOGEE-2S program will expand the reach and impact of the Northern survey through a parallel operation probing the Southern Milky Way on the 2.5-m du Pont Telescope at Las Campanas Observatory in

Chile. There are two options for APOGEE-2 depending on funding. First, we are seeking appropriate funding for a second instrument, in which case we would plan to observe for at least 75 nights per year at the du Pont Telescope from January 1, 2015 through September 15, 2020, and with the original instrument to use all of the available bright time on the Sloan Foundation 2.5-m Telescope at APO starting July 1, 2014. Second, if such funding proves impossible to attain, we plan to move the original instrument to the du Pont 2.5-m to begin planned observations of 75 nights per year from January 1, 2017 through September 15, 2020. In this case, the instrument would use all of the available bright time on the Sloan Foundation 2.5-m Telescope from July 1, 2014 until it is moved.

- The Extended Baryon Oscillation Spectroscopic Survey (eBOSS) will measure the expansion history and growth of structure across all redshifts to  $z = 3$ , including for the first time the currently uncharted realm between  $z = 0.8$  and  $2.2$ . Using quasar and galaxy clustering, as well as Lyman-alpha forest observations at high redshift, we will measure the growth of structure and use the baryonic acoustic feature to measure the Universe's expansion. Furthermore, eBOSS will include two major subprograms, allocated approximately 50,000-100,000 targets apiece. First, the Time Domain Spectroscopic Survey (TDSS) will follow-up known variables, primarily targeting from the Pan-STARRS imaging surveys. Second, the Spectroscopic Identification of eROSITA Sources (SPIDERS) survey will follow-up X-ray sources (primarily AGN and X-ray cluster galaxies) found by the eROSITA satellite. eBOSS will use half of the dark time on the Sloan Foundation 2.5m Telescope at APO from July 1, 2014 through June 30, 2020.
- Mapping Nearby Galaxies at APO (MaNGA) will study the internal structure and formation history of around 10,000 local galaxies using spatially-resolved spectroscopy. Using new multiplexed fiber bundles built for the BOSS spectrograph, MaNGA will perform integral field spectroscopy for a large sample of galaxies spanning a large range of masses, types, and environments. MaNGA will use half of the dark time on the Sloan Foundation 2.5m Telescope at APO from July 1, 2014 through June 30, 2020.

The requirements for observing time for the three programs will be balanced so that the scientific goals of all are optimized within the six-year duration of SDSS-IV observations and so that the observing systems are always used with high efficiency, adapting to weather. In doing so, we will rebalance the three survey time allocations as the survey progresses, based on weather and other uncontrollable losses of observing time.

The top priority will be to ensure the highest possible scientific integrity of the Core Programs. Calibrations must be extensive and trustworthy. Moreover, the intent is that the survey will be well enough designed and the data of sufficient quality that they will remain of scientific interest for many years after the survey has concluded.

The main product of SDSS-IV is the Science Archive, consisting of reliable and easily utilized data sets, data products, and software interfaces from all three surveys. SDSS-IV will construct periodic public releases of validated and calibrated data according to a schedule devised in consultation with the funding agencies.

All SDSS-IV participants will have access to all of the contents of the Science Archive.

Participants may carry out whatever scientific projects they choose using SDSS-IV data, subject to the policy guidelines discussed in §§ 3, 6, and 7.

## **3 Participation in SDSS-IV**

### **3.1 Membership in SDSS-IV**

Membership in SDSS-IV is open to individual institutions. Other collaborative buy-in arrangements will be considered on a case-by-case basis if there are compelling and mutually beneficial reasons to do so. Membership in SDSS-IV provides access to data from all three surveys.

A participating institution formally joins the SDSS-IV project through a Memorandum of Understanding (MOU) with ARC. One element of that MOU will be the acceptance of these Principles of Operation. Membership in SDSS-IV is recommended by the Advisory Council (or by the Steering Committee, prior to the time that the AC is formed) to the ARC Board of Governors. On behalf of the ARC Board of Governors, the Chair of the ARC Board will approve entry of all Participating Institutions into SDSS-IV following vetting of the MOUs by the ARC Business Manager and ARC Secretary/Treasurer.

### **3.2 Participation in SDSS-IV**

A Participant at an SDSS-IV institution is understood to be a long-term scientific staff member -- e.g. faculty (tenured and non-tenured), research-track scientist, or equivalent. In all cases, an individual Participant, postdoc, or other staff member is considered to be “at an institution” if at least 50% of his or her salary is paid by the institution. Exceptions must be specified in the institutional MOU. In the case of multi-institutional post-doctoral fellowship programs, in which a post-doc spends some years at a participating institution and some years at a non-participating institution, the full term of the fellowship may be considered when determining the 50% salary threshold, at the option of the participating institution; note that this rule applies to ongoing programs, not custom arrangements for individuals. Unless otherwise specified in the institutional MOU, graduate and undergraduate students must be enrolled full-time at the institution in question to be considered “at an institution”. Individuals employed with at least half-time salary by their institution who are no more than three years after their first bachelor degree (e.g., individuals working for a year before going to graduate school) may be sponsored as if they are full-time undergraduates.

Full Institutional Membership includes data rights for an unlimited number of Participants from the institution. These Participants may sponsor an unlimited number of postdocs or other short-term staff from the institution. Furthermore, the Participants may sponsor an unlimited number of graduate and undergraduate students at the institution, as described above. The fee for Full Membership will be established by the ARC Board and is anticipated to be approximately \$1050K. All partners are encouraged to join as Full members.

To accommodate institutions that cannot commit to a Full membership, Associate

Institutional Membership includes data rights for a specified number of Slots, where the cost-per-Slot is set to one-fifth of the cost of a Full membership. Typically a Slot will cover one Participant and one postdoctoral researcher sponsored by the Participant, but this balance may be negotiated in specific cases. The Participants and postdocs at an Associate Member Institution are named in the agreement. Participation rights can be moved from one researcher to another with the consent of the Director; the Director (and AC if necessary) has the authority to limit over-use of this flexibility. Participants may sponsor graduate and undergraduate full-time students at their institutions, as described above, who are working directly with them. In addition to these sponsored individuals, postdocs and other professionals who are working for SDSS-IV, with at least half-time salary either being paid in cash by SDSS-IV or being credited as an in-kind project contribution, will also have data-access and other participatory privileges.

A minimum of three Slots is required for an Associate Member Institution to have a vote on the AC, to have a representative on the collaboration Council (CoCo), and to be listed as a member on the official survey acknowledgement. However, an institution may join with one or two Slots.

SDSS-IV will consider membership in the collaboration from “Participation Groups” (PGs), which are collections of active scientists distributed across three or more distinct institutes, departments, and/or universities from the same country. The PG should arrange for a central office that is responsible for signing the Memorandum of Understanding, that will appoint the representative to the AC, that will handle the cash payments, that will ensure that the Principles of Operation are followed, and that will provide a point of contact in all other matters concerning the PG’s membership in the SDSS-IV Collaboration. PGs will be treated similarly to Associate Institutional Members as described above, but with the following incentive: for every 5 paid Slots in good standing, data rights will be provided for one additional Slot. As with Associate Institutional Members, each Slot typically covers one long-term staff member and one postdoc, but the balance may be negotiated when 1:1 is not the most appropriate division for the member institutions. A PG will receive a vote on the AC and CoCo and listing in the official boilerplate if it has at least three Slots. PGs are subject to the same rules as Associate Institutional Members; in particular, membership is based on a list of named Participants (including the postdocs) that can only be changed with the consent of the Director. Participants can work with an unlimited number of students, again as defined for Associate Institutional Members. The payment schedule is the same as for other institutional members, as described below.

Individual MOUs may specify departures from these general guidelines for data access and publication rights.

All Participants are expected to read and abide by the PoO and the SDSS-IV Publication Policy and are responsible for protecting the scientific integrity of SDSS-IV and the data rights of other Participants.

The SDSS-IV Director, upon approval by the AC, may designate scientists at other institutions to be “External Participants,” with full rights of data access and participation in SDSS-IV science projects. Significant existing or potential contributions to the project as a whole will be given special consideration in deciding on External Participant status, with the typical

expectation of a 1-year FTE contribution to SDSS-IV infrastructure and project deliverables. Designation as an Architect (see § 6.2) is not necessarily sufficient to earn External Participant status, as the contributions considered for Architect status may be broader in character than those that qualify as contributions for External Participant status. Participants who leave a Participating Institution, or who otherwise lose their Participant qualifying status, retain their Participant status only with an External Participant designation. Rights to share data access with postdoctoral fellows, students, or others will be considered on an individual basis.

Any Participant can propose to sponsor an “External Collaborator”, a non-Participant who is granted access to SDSS-IV data and/or co-authorship on an SDSS-IV paper in order to assist with a specific project. The sponsor must present the proposal to the Collaboration Council (see § 4.11), conforming to standards set out by them. The CoCo reviews the case and issues a recommendation, which the SDSS-IV Spokesperson brings to the MC for final approval. Should an External Collaborator be proposed from an Associate Member or Participation Group, the Director will consult with the Chair of the AC about the proposal prior to the decision being made. If granted, data access and/or co-authorship rights will be restricted to the specific person for the specific project. All such appointments will be reviewed annually by the SDSS-IV Spokesperson to determine if continuation is warranted.

Participants, post-docs, or students leaving a Participating Institution without External Participant designation should use the External Collaborator mechanism in order to complete the specific projects on which they have been actively working. Such requests follow the same mechanism as above; however, the standards for approval of the proposal set by the Collaboration Council may be more lenient for this case.

SDSS-IV fully endorses the principles of professional conduct articulated in Article X of the Bylaws of the American Astronomical Society and expects all those associated with the project to follow those precepts. Specifically, SDSS-IV communications (meetings, phone conferences, e-mail exchanges) are intended to “provide an environment that encourages the free expression and exchange of scientific ideas.” It is the responsibility of members of the SDSS-IV Collaboration to ensure that such discourse is “conducted in a professional atmosphere in which all participants are treated with courtesy and respect.”

Full details of membership in the project will be described in the individual MOU with each institution.

### **3.3 Contributions to SDSS-IV**

Fees for Full Institutional Membership in SDSS-IV will be set by the ARC Board of Governors. Contributions can be cash or in-kind and are measured in US dollars. Only direct costs will be counted as in-kind contributions (i.e., including fringe benefits but excluding institutional overheads). All in-kind contributions need to specifically address items in the Director's budget and must be approved in advance by the Director, in consultation with the MC. These in-kind contributions will be reported annually to the AC. All such details, including the schedule and value of in-kind contributions, will be elaborated in the institutional MOU with ARC. Hardware and software developed previously for SDSS-I, II, or III will generally not be counted as an in-kind contribution for SDSS-IV.

SDSS-IV will have a total of seven payments, each of 1/7 of the total membership fee. The first payment is due by June 30, 2013 and the second by April 30, 2014, shortly before the start of SDSS-IV operations. Subsequent payments are due by January 31 of 2015, 2016, 2017, 2018, and 2019. For Associate Institutional Members or Participation Groups, all payments are scaled according to the 1/5 factor per Slot, as described above.

Recognizing the importance of early funding to SDSS-IV preparation and the greater risk attached to earlier contributions, SDSS-IV may offer financial incentives to encourage such contributions, e.g., by crediting them at more than face value.

Each institution's MOU will define the penalties should the institution fail to fulfill a promised payment. Typically the penalty will be that the institution will forfeit their rights to data taken after the default date. Specific situations will be dealt with if and when they arise by the Director, the MC, and the AC.

Participation in SDSS-IV is on a shared-risk basis. The project will make its best effort to meet the goals set out under "Scientific Program" above, but it cannot guarantee success for any particular specification listed there. There will be no refunds of project contributions in the event of descope of SDSS-IV or withdrawal of an institution. If the SDSS-IV project is dissolved entirely prior to 2018, then the remaining cash, after payment of all residual obligations as well as any settlements with funding agencies, will be distributed to the member institutions, with pro-rated fractions set by the amount of cash contributions toward MOU obligations, excluding any incentive bonuses.

It is ARC policy that all work packages negotiated for support of the SDSS projects (e.g., in which ARC provides funds for hardware or software development or operations support at one of the Member Institutions) require a waiver of overhead rates, with the sole exception of operations at Apache Point Observatory. This policy of having institutions where work is done carry the burden of the IDC costs has been a critical factor in obtaining support for SDSS from funding agencies, foundations, and institutions. It will continue in force for the SDSS-IV project.

## **4 Management**

### **4.1 ARC Board of Governors**

The ultimate responsibility for all aspects of SDSS-IV rests with the ARC Board, including approval of annual budgets, requests for outside funding, and the appointment of the Director.

### **4.2 Advisory Council (AC)**

The AC advises the ARC Board on matters relating to the SDSS-IV project. The AC consists of one representative from each of the Participating Institutions with voting rights, i.e., all Full Institutional Members plus Associate Institutional Members and Participation Groups with three or more slots. The Chair of the AC may invite additional non-voting attendees to any meeting, but institutions with fewer than three slots do not have regular representation on the AC.



The Chair of the AC will be appointed by the ARC Board for a specified term. The ARC Board will request nominations by the Participating Institutions for their representatives on the AC.

The AC members are the primary channel through which information flows between the ARC Board and Participating Institutions. A majority vote of the AC is required before a recommendation to admit a new Participating Institution is made to the ARC Board. One of the important functions of the AC is to transmit the annual operations budget of the project, as formulated by the Director, along with its recommendations to the ARC Board for its approval.

The AC will meet as deemed necessary, generally at least twice per year. Meetings will typically be scheduled by the AC chair, but can also be scheduled on the request of two or more AC voting members. Meeting dates will be set and announced well in advance to assure good attendance. The agenda will be distributed at least five working days in advance of the meeting to AC members, the ARC Chair, the ARC Secretary, the ARC Treasurer and the SDSS-IV Director. The AC Chair is responsible for timely filing of approved meeting minutes with the ARC Secretary, and is responsible for informing the Collaboration of any decisions by the AC. The SDSS-IV Spokesperson will ensure that a public version of the minutes is posted to the Collaboration in a timely manner.

A quorum of the AC will consist of a simple majority of the voting members, including proxies. AC decisions will be approved by a simple majority of a quorum. Each voting member of the AC will have one vote. If an AC member is unable to attend a meeting, his or her institution may appoint an alternate to attend and vote in his or her place or may give its proxy to another AC member. The Chair may vote or not, at his or her discretion; the Chair may, but is not compelled to, break a tie vote.

Any action of the AC may be taken by electronic ballot. The electronic ballot period shall be no less than seven calendar days. The results of any electronic ballots will be distributed by email to the AC after the close of the ballot period and filed with the minutes of the succeeding AC meeting.

It is the responsibility of AC members to ensure that their Participants and relevant institutional officers (e.g. Departmental Chair, Director of Sponsored Programs, etc.) are informed of SDSS-IV policies and decisions.

The AC will also have an AC Executive Committee (AC EC). It is chaired by the Chair of the AC and includes the Chair of the ARC Board (ex officio, non-voting). In addition to these two individuals, the AC EC includes four at-large members appointed by the AC.

The AC EC will provide advice and guidance to the SDSS-IV Director through more frequent communication. The AC EC will work with the Director to negotiate institutional memberships and other MOU-level agreements. Minutes of AC EC meetings will be circulated to the full AC within two weeks.

In addition, the AC can vote to give the AC EC the right to act on its behalf for certain tasks, such as approval of memberships and External Participant applications. In exceptional cases, with approval of both the Chairs of the AC and the ARC Board, the AC EC has the

authority to act for the AC on other matters. When the AC EC acts on behalf of the AC, the AC Chair will inform the AC of the action within two weeks. All actions and approvals by the AC EC will require positive votes from at least 3 of the 5 AC EC voting members, with no negative votes. If the AC EC cannot reach a consensus, then the AC Chair may bring the issue to the full AC without prejudice.

### **4.3 SDSS-IV Director**

The ARC Board has delegated to the SDSS-IV Director the authority for organizing and directing all aspects of the project, including the development and delivery of all necessary hardware and software and the operation of the survey. To those ends, the SDSS-IV Director is responsible for:

- creating job descriptions and making appointments of key personnel to the roles defined in this document, and maintaining the list of those personnel;
- keeping the AC informed on the status of the project, including any major problems and plans for resolving them;
- drafting MOUs with any new Participating Institution for concurrence by the AC and approval by the ARC Board;
- formulating, with the assistance of the Project Scientist, the formal set of instrument, software, and data requirements needed to meet the scientific goals of the three surveys;
- supervising all financial aspects of the project;
- preparing, with the assistance of the ARC corporate office, annual budgets, to include the funds and in-kind services needed for all SDSS-IV operations, as well as regular financial summaries of expenditures and obligations;
- leading the preparation of proposals to fund the operations of SDSS-IV (§ 7) and assisting the ARC Board and AC in other relevant fund-raising activities as requested;
- working with ARC officers in conducting the project so as to comply with the terms of funding awards received by ARC from federal agencies and private entities;
- ensuring that other goals specified in funding proposals, such as SDSS-IV's Education and Public Outreach plans, are met;
- advancing gender and ethnic diversity in the project's scientific activities and leadership;
- undertaking other responsibilities identified in this document.

The SDSS-IV Director will be appointed for a fixed term by the ARC Board, taking into consideration the recommendation of the AC. The AC will identify and evaluate candidates for the position of SDSS-IV Director when the incumbent's term is coming to an end or when the position is vacated unexpectedly.

The Director has final authority over the individual surveys as well as the authority to resolve conflicting needs between surveys, including allocation of fibers and distribution of

observing time by lunar phase. The Director also has the authority to approve the detailed observing plan within the spirit of the goals described in Section 2.

#### **4.4 SDSS-IV Project Scientist**

The SDSS-IV Director has delegated to the SDSS-IV Project Scientist the responsibility for providing the overall quality assurance for the project and ensuring its scientific integrity. From this perspective, the SDSS-IV Project Scientist monitors the project in all its phases and evaluates the scientific impact of changes or compromises made in the course of constructing the hardware, preparing the software, and developing the plans for commissioning and operations. The SDSS-IV Project Scientist plays a leadership role in organizing and overseeing the scientific effort of the Collaboration.

The Project Scientist works to ensure that management decisions support the science goals and technical requirements of SDSS-IV and that the surveys function together cleanly. He or she will work with the Survey Scientists to ensure that each survey develops detailed requirements and validates their data processing and data releases against those requirements. He or she is responsible for informing the SDSS-IV Director and SDSS-IV Program Manager of the state of compliance of Survey Operations with survey metrics.

#### **4.5 SDSS-IV Program Manager**

The SDSS-IV Program Manager assists the Director in the performance of his or her responsibilities. The Program Manager, with the support of the Project Office, is responsible for developing and maintaining project schedules. He or she is responsible for preparing annual and cost-to-complete budgets for consideration by the SDSS-IV Director and SDSS-IV Project Scientist prior to their submission by the SDSS-IV Director to the AC. He or she is responsible for tracking project expenditures and reporting them, together with any deviations from the approved budgets, to the SDSS-IV Director on a timely basis. He or she is responsible for preparing the quarterly reports that are distributed to the AC and for tracking expenditures against the approved budget.

The Program Manager coordinates the engineering effort at Apache Point Observatory with the efforts of the engineering groups at the Participating Institutions and the requirements of the observing program. He or she develops an adequate set of internal project reviews and is responsible for organizing and chairing these reviews. He or she identifies resources at the Participating Institutions when additional resources are needed to meet schedules. He or she is also responsible for keeping the SDSS-IV Director and SDSS-IV Project Scientist informed on the cost and schedule performance of Survey Operations.

#### **4.6 SDSS-IV Spokesperson**

The SDSS-IV Director has delegated to the SDSS-IV Spokesperson the primary responsibility for fostering the scientific productivity of the Participants, representing SDSS-IV to the outside world, raising the visibility of SDSS-IV within the astronomy and physics communities, and maintaining good morale in the Collaboration. He or she is charged with

formulating and implementing guidelines for project publications and for coordinating public presentations. The SDSS-IV Spokesperson is elected by the Collaboration from a slate of candidates nominated by the Collaboration and approved by the MC. The Director may appoint an interim Spokesperson prior to the first election, which should occur before the end of 2013.

The Spokesperson, in concert with the CoCo and the MC, will establish additional structures for the Collaboration science efforts, such as the formation of Working Groups or the appointments for Survey Science Team Chairs.

## **4.7 Central Project Office (CPO)**

SDSS-IV is managed by the Central Project Office, chaired by the Director and including the Program Manager, Project Scientist, ARC Business Manager, and the Spokesperson.

The CPO is responsible for financial management of the project. It requests and receives annual payments from the Participating Institutions. It receives and manages funds from sponsoring governmental agencies and private sources. It disburses funds to the Project Team PI's and other project elements on established schedules. Details of CPO operations in these and other areas are given in the Project Execution Plan.

## **4.8 SDSS-IV Management Committee**

The Central Project Office is advised by the Management Committee (MC), which includes the above CPO members, all of the survey PIs, the Survey Coordinator, the Sloan Telescope Lead Scientist, and the Principal Data Scientist. The Director has the authority to change the makeup of the MC or delegate specific areas of responsibility within the MC as he or she sees fit. Formal communications of the MC with the ARC Board or AC are through the SDSS-IV Director.

The Director, Project Scientist, Program Manager, and Spokesperson constitute the Executive Management Committee, which is authorized to make decisions in the event that it is not practical to convene the whole Management Committee.

## **4.9 Survey Teams**

For each Core Program, there is an associated Survey Team led by a Principal Investigator who reports to the Central Project Office and sits on the Management Committee. The efforts of each Team will be guided by a Statement of Work prepared by the Management Committee, containing a set of deliverables and a schedule for delivery.

Each of the Teams will designate a Survey Scientist, who is responsible, in consultation with the SDSS-IV Project Scientist, for developing detailed scientific requirements for that Team's hardware, software, and data deliverables and for certifying that they meet the requirements. Each of the Teams will also designate an Instrument Scientist, who is responsible for the design, construction, test, and implementation of associated hardware.

Each of the two Teams undertaking instrumentation work (APOGEE-2 and MaNGA) will also employ a Project Manager, who reports to the SDSS-IV Program Manager for schedule and

budget performance.

The Teams also serve as centers of expertise to advise on matters of the optimal observing strategy, calibrations programs, necessary systems or software development, and data release content. A Team may propose to the Project Scientist plans for improvements for calibration, analysis software, data processing software, and data distribution to the Collaboration.

## **4.10 Operations Teams**

The Operations Teams execute the common efforts in the survey, primarily observatory operations and data management tasks. Each team has a designated lead who sits on the Management Committee. A more exhaustive list of their scopes of responsibility is listed in the Project Execution Plan.

The Sloan Telescope Lead Scientist oversees the Apache Point Observatory Team, which executes the observations, maintains and upgrades the hardware and software as appropriate, and commissions new instrumentation.

The management plan for APOGEE-2S operations at Las Campanas Observatory will be developed as part of a signed agreement between ARC and the Carnegie Institution for Science.

The Survey Coordinator leads the Joint Survey Operations Team, which coordinates the observational strategy, plate drilling, and monitoring of progress among the surveys.

The Principal Data Scientist leads the Data Management Team, with members drawn from each of the Survey Teams. The Director will retain the final authority to approve data releases to the Collaboration or to the public.

## **4.11 Collaboration Council**

The Collaboration Council (CoCo) advises and supports the Spokesperson concerning scientific matters. The Spokesperson chairs the CoCo. It consists of one member from each Participating Institution with three or more Participants plus one member who represents, and is elected by, the Associate Institutions with fewer than three Participants. The CoCo will usually meet on a biweekly basis.

## **4.12 Change Control Board**

It is inevitable that deviations from the intended plan will occur, and the project needs ways to deal with these as they arise. A standing Change Control Board (CCB) will be constituted by the Director and charged to give formal evaluations of any substantive departures from the Scientific and Technical Requirements. The Director, Project Scientist, and Program Manager will be members of the CCB. Other CCB members will be chosen to provide expertise across a broad range of project components; temporary additional members may be added by the Director as appropriate.

## 4.13 Ombudsperson

The ARC Board will appoint a standing Ombudsperson for the project to help resolve disagreements arising in any aspect of the project in an informal manner. As a neutral third party, the Ombudsperson does not advocate for the project or for either party in a dispute. The objective is to provide a process for achieving a fair and reasonable settlement working within existing policies and procedures. When a request for services is received, the Ombudsperson will work with each party to identify appropriate alternatives that address the conflict and to achieve a mutually satisfactory resolution. Consultation with the Ombudsperson does not preclude later pursuit of a resolution through formal channels if that is still desired.

## 5 Risk Management

The SDSS-IV project includes hardware and software development at distributed sites in order to meet specifications defined by the scientific and technical requirements. The project schedule includes delivery dates for critical items; normally, it is expected that any delays in the delivery or implementation of critical items will be absorbed by the contingency built in to the schedule.

When significant departures from the intended plan occur, the Change Control Board can be convened. The Director, as advised by the Management Committee, will determine when invoking the CCB is warranted. The Director will charge the CCB with providing a specific recommendation or set of options to address the problem while balancing the needs of the various programs. This may include schedule changes or descopes, for example, or a recommendation to redirect resources in a major way. The CCB may also be invoked to expand the Scientific and Technical Requirements in the event that some aspect of the project requires further definition.

CCB recommendations that alter the project goals or structure as described in these PoO must be submitted to the SDSS-IV AC for its approval before they are implemented by the Director.

APOGEE-2S requires the development of a collaboration with The Observatories of the Carnegie Institution for Science (OCIS) regarding the use of observing facilities at Las Campanas Observatory. To move forward with the APOGEE-2S phase will require a signed agreement between ARC and OCIS, to be approved by the AC and ARC Board by March 31, 2014. If a signed agreement does not exist by that point, the CCB will be convened to make a recommendation to the SDSS-IV AC.

APOGEE-2S can proceed either with a second spectrograph (the “parallel” APOGEE-2S) or by moving the existing APOGEE spectrograph to Las Campanas Observatory (the “serial” APOGEE-2S), depending on available funding. Based on the funding success, the Director will recommend one of these two programs to the SDSS-IV AC for approval by July 15, 2014.

## 6 Publication Policies

Any member of the project who is authorized to have access to the SDSS-IV Science Archive has authorship rights on published papers as described in the policies and procedures specified below. Full details will be given in the document *SDSS-IV Publication Policies*, to be developed by the CoCo for approval by the AC.

### 6.1 Research Projects and Publications

SDSS-IV is intended to be an open collaboration, and members are entitled to work on any project undertaken within the purview of SDSS-IV. Each research project must be announced to the Collaboration, specifying the subject matter, project leader, known collaborators, a contact person, and the anticipated duration of the project. Lists of proposed projects and publications will be maintained by the SDSS-IV Spokesperson and made available on the internal project website. Student thesis projects will also be listed; any special protections for such projects will be described in the *SDSS-IV Publication Policy*. These policies apply only to data that have not been released to the public at the time the analysis was started. It is understood that people who join projects make themselves available to undertake appropriate tasks in support of the effort as assigned by the project leader.

Publications are expected to be posted for review within the collaboration a minimum of three weeks before being submitted to a journal or publisher.

### 6.2 Authorship

Any member of SDSS-IV who is authorized to have access to the Science Archive may, at any stage of a research project within the SDSS-IV collaboration, request that his/her name be added to the list of authors, with the presumption that permission will be granted if he or she has made any significant contribution to that specific research project.

Scientists who have SDSS-IV “Architect” status can opt to be co-authors on any paper based on proprietary SDSS-IV data. (However, technical papers describing aspects of the SDSS-IV hardware, software, or procedures are not automatically open to authorship requests.) Architect status is granted based on significant contributions, typically 1 year FTE effort, to the design, construction, execution, or management of SDSS-IV. Requests for such status should be made to the Spokesperson, who will bring the case to the CoCo for recommendation and to the MC for approval.

By signing their names to an SDSS-IV paper, all co-authors are understood to be accepting responsibility for the paper according to the guidelines given in the *SDSS-IV Publication Policies* and the *Guidelines for Professional Conduct* of the American Physical Society ([http://www.aps.org/policy/statements/02\\_2.cfm](http://www.aps.org/policy/statements/02_2.cfm)).

Disputes concerning matters of authorship will be referred to the SDSS-IV Spokesperson. If the Spokesperson is a party to the dispute or is unable to resolve it, the matter will be referred to the Ombudsperson, who will attempt to mediate a resolution. Unresolved disputes may be appealed to the Director or, if necessary, to the AC Executive Committee, whose

decisions will be final.

### **6.3 Additional Guidelines for Implementation**

The SDSS-IV Spokesperson may develop more detailed guidelines concerning the implementation of the publication policies, in consultation with the CoCo. A copy of these guidelines will be available from the Spokesperson. The guidelines must be read and agreed to by the Participants, a relevant institutional officer at Participating Institutions, and collaborators. These guidelines must be consistent with and may not supersede the basic principles of the PoO. The SDSS-IV Spokesperson is responsible for updating these documents.

### **6.4 Sanctions**

The *SDSS-IV Publication Policies* document specifies the sanctions that can be imposed for infractions of the stated policies. These include a delay in publication and, in extreme cases, debarment from access to SDSS-IV data.

## **7 Proposals and Initiatives**

### **7.1 Proposals by ARC As-A-Whole**

Proposals submitted by ARC as-a-whole to government or philanthropic sources to secure funds to support the construction, operation, or scientific exploitation of SDSS-IV require approval by the ARC Board following a recommendation by the AC.

### **7.2 Other Proposals to Fund Scientific Research**

Proposals from Participating Institutions involving use of SDSS-IV data or facilities that have the potential to conflict or compete with the Project's own fund-raising proposals must be brought to the attention of the Director well ahead of submission. In unusual circumstances, the Director or Chair of the ARC Board may require modification of such a proposal prior to submission, with notification of the action to the AC. The guiding principle is that the Project must be able to present an organized, rational funding plan to financial sponsors and the scientific community.

Particular caution is required when a proposal requests funding for work that is implied to be important to producing the SDSS-IV public release data sets, or when a proposal states that results from the supported work will be included in the SDSS-IV public Data Releases. Uncertain cases should be discussed in advance with the Director. The Director may provide endorsement letters as documentation for a proposal when appropriate.

Funding proposals for scientific exploitation of SDSS-IV data do not require approval or vetting from the Project. However, such proposals must not conflict with the PoO or with the submitting institution's own MOU (e.g., by implying data access rights to someone who is not entitled to them), and they may not commit to public release of SDSS-IV data ahead of the Project's planned public Data Releases. Proposing institutions or individuals are responsible for



all incremental costs deriving from the proposed research.

### **7.3 Initiatives for Extension Beyond the Primary Survey**

Initiatives to use or augment SDSS-IV hardware, operations, or data for purposes that are not part of the Core Programs may be approved by the SDSS-IV Director after review by the SDSS-IV Project Scientist to assess scientific merit and then by the SDSS-IV Program Manager to ensure their technical appropriateness and assess their financial impact. Subsequent review by the AC and approval by the ARC Board is required only if the SDSS-IV Director determines there may be financial impact on the Collaboration or potential conflict with existing institutional arrangements. If there are deemed to be such impacts, the SDSS-IV Director will determine any required modification of the PoO and will prepare a recommendation to the AC. The Chair of the AC will transmit the Initiative, the SDSS-IV Director's recommendation, and the AC's own recommendations to the ARC Board if necessary. Approval of the Initiative may be granted contingent upon the proponents securing the necessary financial resources.

### **7.4 Initiatives for Use of Intellectual Property**

Initiatives to use the intellectual property of the SDSS-IV Collaboration will be covered by the Intellectual Property Policy of ARC, Inc., a copy of which is available from the ARC Secretary.

## **8 The Apache Point Observatory**

SDSS-IV facilities will operate on ARC's Apache Point site and share infrastructure and administrative staff with the 3.5-meter telescope, affording both projects the benefits of a broader skill mix. Shared staff and other common operations support costs will be apportioned between the projects by mutual agreement of SDSS-IV and 3.5-meter directors. SDSS-IV will provide its own dedicated observing staff. Data from SDSS-IV and 3.5m environmental monitoring equipment will be available to users of both telescopes.

When the SDSS-IV project is completed, operation and/or disposition of its facilities will be determined by the ARC Board, with advice from the AC. Proper consideration will be given to any prior contributions to the capital value of the assets. Disposition of certain assets will be made in accordance with special provisions in individual institutional MOU's.

## **9 Document Revision History**