D.3 ASTROPHYSICS RESEARCH AND ANALYSIS PROGRAM

NOTICE: Amended September 17, 2020. A number of changes have been made to this program element including: updates to Specific Considerations and Exclusions in Section 1.2, Suborbital-class Investigations (Section 1.2.1), Supporting Technology (Section 1.2.3), Laboratory Astrophysics (Section 1.2.4) where an additional allowance for laboratory astrophysics equipment has been added, General Information (Section 2.1) and the phone numbers for the points of contact in the summary table of information (Section 3). New text is in bold and deleted text is struck through. Due dates remain unchanged.

Prospective proposers should note that mandatory Notices of Intent will be due October 23, 2020, and the proposal deadline is December 17, 2020. This is roughly 3 months earlier than in previous years. This will enable the planned start date for funding for all proposers to begin sooner and with the same window, as opposed to the previous different dates for NASA and non-NASA PIs.

Please note the new language in Sections 1.2 and 1.2.1 regarding data management and archiving.

The allowance for "Co-Investigator Proposals" for suborbital and suborbital-class investigations (permitted by APRA in prior years) has been removed in APRA-2020. Such proposals shall now budget in accordance with the rest of APRA proposals in that the PI will directly subcontract to all non-U.S. Government participating entities.

ISS-attached suborbital-class payloads are not solicited in this APRA opportunity.

1. Scope of Program

1.1 Overview

The Astrophysics Research and Analysis Program (APRA) program solicits basic research proposals for investigations that are relevant to NASA's programs in astronomy and astrophysics and includes research over the entire range of photons, gravitational waves, and particle astrophysics. Awards may be for up to four years' duration (up to five years for suborbital investigations), but shorter-term proposals are typical; four-year or five-year proposals must be well justified. ~~Proposals for suborbital investigations are particularly encouraged.~~ APRA investigations may advance technologies anywhere along the full line of readiness levels, from Technology Readiness Level (TRL) 1 through TRL 9. The emphasis of this program element is on technologies and investigations that advance NASA astrophysics missions and goals.

1.2 Categories of Proposals

The APRA program seeks to support research that addresses the best possible (i) state-of-the-art detector technology development for instruments that may be proposed as candidate experiments for future space flight opportunities; (ii) science

and/or technology investigations that can be carried out with instruments flown as suborbital-class payloads on balloon-borne, sounding rocket, CubeSat, or other platforms; and (iii) supporting technology and laboratory research that are directly applicable to space astrophysics missions. Accordingly, proposals are solicited in the following four broad categories:

- Suborbital/Suborbital-class Investigations
- Detector Development
- Supporting Technology
- Laboratory Astrophysics

Specific Considerations and Exclusions:

- Investigators proposing stand-alone detector development, including detector development that features a ground-based demonstration component, should propose to the Detector Development category, whereas proposals for which detector development is integrated into a suborbital/suborbital-class flight project should be submitted to the Suborbital Investigations category.
- The Laboratory Astrophysics category of this program element includes theoretical investigations that support the determination of fundamental atomic, molecular, nuclear, and solid-state parameters with relevance to NASA Astrophysics missions (see Section 1.2.4). However, all other theoretical investigations are solicited separately under the Astrophysics Theory Program described in program element D.4 of this ROSES NRA.
- This program element excludes proposals for investigations that are in scope of the Exoplanet Research Program (XRP; E.3 of this ROSES NRA). Specifically, this exclusion is for Laboratory Astrophysics**, data analysis method, or other algorithm/software development** investigations that are focused upon measurements **or techniques** related to characterizing the properties of exoplanets, protoplanetary disks, or debris disks. Potential proposers developing science cases in these areas are directed to Appendix E.3. Investigations that advance technology development for exoplanet space missions or conduct suborbital-class experiments that advance exoplanet science, remain appropriate for the APRA program.
- The APRA program element is no longer intended to support ground-based observations except in the context of demonstrating detector development and supporting technology maturity.
- The Fundamental Physics discipline area supports proposals: 1) to conduct tests of fundamental laws of physics or 2) to develop experimental concepts and/or related technologies to test fundamental laws of physics. Proposals submitted to this discipline area must be related to an Astrophysics space project (suborbital, orbital, lunar**,** etc.). This discipline area is not intended to support applied physics or laboratory experiments. Investigations predominantly theoretical in nature should be directed to the Astrophysics Theory Program or to other Federal agencies, as appropriate.
- Projects directed mainly toward the analysis of archival data are solicited under the Astrophysics Data Analysis Program described in Appendix D.2 of this ROSES NRA.

- If a proposal is offered as a direct successor to a previous NASA award, it should include a description of the predecessor effort, including any significant findings, and describe how the proposed work extends the previous accomplishments. See the 2020 *NASA Guidebook for Proposers* for more details.
- The Principal Investigator (PI) institution is expected to fund participating Co-Investigator(s) (Co-I(s)) via subawards, except where the Co-I is at a Government laboratory, including NASA Centers and the Jet Propulsion Laboratory (JPL). However, the proposed budget must explicitly include the funding required for participating Co-Investigator(s) at Government laboratories, including NASA Centers and JPL.
- Projects that are devoted to technology development efforts but will not generate scientific data may satisfy the requirement for a data management plan (DMP) by simply noting in the separate 2-page DMP section of the proposal (See Section 1.1 of D.1, The Astrophysics Research Program Overview), that a DMP is not required because the proposed projects are in the Detector Development or Supporting Technology category. Proposals submitted in the categories of Suborbital Investigations or Laboratory Astrophysics are required to provide data management plans. **Note that the data under consideration need not include the raw data generated during a project, but at a minimum are any processed data needed to validate the scientific conclusions of peer-reviewed publications (such as data underlying graphs, images, spectra, and tables) and associated data and software necessary for the replication/reproduction of published results.**
- Proposals to advance detectors or supporting technologies, other than for data analysis methods, in support of strategic missions that have transitioned to having funded technology lines or that are in Phase A or beyond (e.g., Athena, LISA, Ariel/CASE, **Roman (formerly known as** WFIRST**)**, Euclid, XRISM, JWST) are excluded from APRA, as these technologies are expected to be supported by the mission funding. Technology development for potential future Explorers or Probe-class missions is allowed within APRA.

1.2.1 *Suborbital/Suborbital-class Investigations*

This APRA category supports science investigations and/or technology development utilizing payloads flown on sounding rockets, balloons, CubeSats, commercial reusable suborbital rockets, or similar-class payloads flown as flights of opportunity. Suborbital payloads may be recovered, refurbished, and re-flown in order to complete an investigation. **Proposals with a total proposed cost of over $10M must be submitted to the Astrophysics Pioneers program element of ROSES if they are compliant with that element (that is, not a sounding rocket).**

Suborbital launch vehicle services include those provided by the NASA Sounding Rocket Program Office (SRPO)**,** the NASA Balloon Program Office (BPO)**,** and commercial suborbital reusable launch vehicle **(sRLV)** services **(including balloons) such as those accessed** through the Flight Opportunities Program (**https://www.nasa.gov/directorates/spacetech/flightopportunities/flightproviders**) of NASA's Space Technology Mission Directorate (STMD). In keeping with the process detailed in the *ROSES Summary of Solicitation*, such proposals must follow the

guidelines in section V(**c** ~~b~~)(iii). The Science Mission Directorate also provides for CubeSats. These are described in Section V of the *ROSES Summary of Solicitation*. Investigators are strongly urged to discuss their proposed payload with the contact person(s) for the appropriate Program, as given in that section. Proposers may propose to use a Suborbital Reusable Launch Vehicles to acquire a suborbital launch (including balloons) ~~in keeping with the process detailed in the *ROSES Summary of Solicitation*, such proposals must follow the guidelines in section V(b)(iii)~~. **For all of the above options, SMD will provide funding for the launch services and therefore the cost need not be included in the proposal.** Proposers may also negotiate their own launch services as part of their proposal, in which case the PI is responsible for all aspects of that service contract including its full cost.

Any suborbital investigation involving a sounding rocket or balloon flight with unique requirements must obtain a letter of mission feasibility from the relevant program office point of contact (listed in Section V(b) of the *ROSES Summary of Solicitation*). Unique requirements include, but are not limited to, remote launch campaigns and constraints on the time/date of launch. The mission feasibility letter must be included in the proposal submission, but it does not count against the proposal page limit.

A discussion of the plans for management and for reduction and analysis of the data must be included in the proposal. Moreover, the data management plan (DMP) outside of the page-limited S/T/M part of the proposal must present a plan for making the science data that derives from the investigation publicly available for the long term, in an appropriate archive, such as (but not necessarily) one of the official archives at http://science.nasa.gov/astrophysics/astrophysics-data-centers/. The adequacy of the DMP will be part of the evaluation of the Merit of the proposal and, even if an investigation is selected, should the DMP not satisfactorily present the plan for archiving the science data, the award will be delayed until a satisfactory revised DMP is submitted.

Although most awards are for three- or four- years **in** duration, ~~a~~ five-year proposal**s** ~~may be accepted~~ to develop a completely new, highly meritorious suborbital-class investigation through its first flight **are eligible**. Because of the anticipated greater degree of complexity, the Scientific/Technical/Management section of **all** proposals for **suborbital (and Suborbital-class)** investigations may be 20 pages long, instead of the default 15 pages specified in the *NASA Guidebook for Proposers*.

Budgets are expected to cover all aspects of the proposed investigation, typically (but not always) including payload development and construction, instrument integration and calibration, launch, and data analysis and dissemination/archiving. The number of investigations that can be supported is limited and heavily dependent on the funds available to this program. It is allowable to propose suborbital-class investigations to APRA that do not consist of an entire investigation, defined as a new start through flight and data analysis and archiving, within the maximum five-year period of performance. Investigations that would not complete within the proposed period must make clear what portion of the entire investigation is being proposed and what portion is being deferred to a later proposal and should provide rough estimates for schedule and budget for the deferred portion. The proposal review will consider the merit of the complete investigation, but will also consider the value of only the portion being proposed as a

meritorious precursor for the entire investigation. Note that SMD does not carry reserves to accommodate any cost overrun incurred by a particular investigation, including the loss of the payload owing to a rocket or balloon system failure. Therefore, failure to achieve the proposed goals within the proposed time and budget could require either descoping the initially proposed investigation, delaying it, canceling a particular launch date opportunity, or canceling the investigation altogether.

NASA considers suborbital and suborbital-class investigations to be research and technology projects governed by NASA Procedural Requirements (NPR) 7120.8. Accordingly, such investigations should expect to be required to present a Project Plan (cf. § 4.2.7 of NPR 7120.8A), comprising an agreement on implementation approach, resources, cost, reviews, schedule, and other plans, in order to be approved to proceed from the formulation phase to implementation phase. Typically, this will be required of new investigations during the second year after initiation of funding. Should review of the Project Plan identify significant challenges (in, for example, cost, schedule or technology maturity) a Cost and Continuation Review (CCR) may be held. Outcomes of the CCR may include termination of the project or continuation with a revised baseline. For purposes of tailoring NPR 7120.8, the 'program manager' shall be the appropriate point-of-contact as listed in this program element (or that person's successor) and the 'project manager' shall be the PI of the investigation or a person selected by the PI for this role; issuance of an award shall be considered as Authority to Proceed and hence the beginning of formulation. At the end of each project year, the project manager shall submit an annual report to fulfill the role of a Continuation Assessment, with the final one being considered to fulfill the submission for Project Closeout, unless otherwise documented in the Project Plan.

Suborbital and suborbital-class investigations provide unique opportunities, not only for executing intrinsically meritorious science investigations, but also for advancing the technology readiness levels of future space flight detectors and supporting technologies and preparing future leaders of NASA space flight missions, such as early-career researchers and graduate students. For these proposals, specific factors that will be considered when evaluating a proposal's intrinsic merit are the scientific merit as defined in **Appendix D of** the *Guidebook for Proposers* and, in addition, the degree to which it advances the technology readiness level of a detector or supporting technology, and secondarily the degree to which it advances the readiness of early-career researchers or graduate students to assume leadership roles on future NASA space flight missions.

The intent is to support more small instruments for science investigations, technology development, and/or training of early-career scientists and engineers. Investigators should identify, on the proposal cover page, which of these three categories is the main focus of the proposal.

1.2.1.1 *Sounding Rocket Payloads*

Investigators proposing payloads to be flown on sounding rockets should answer the program-specific questions on the APRA proposal cover pages. For planning purposes, the Sounding Rocket Program Office uses this information to generate a rough order-of-magnitude cost estimate for the operational requirements associated with a proposed

investigation. The required information includes the envisioned vehicle type, payload mass, trajectory requirements, launch site, telemetry requirements, attitude control, or pointing requirements, and any plans for payload recovery and reuse.

1.2.1.2 *Balloon Payloads*

The Balloon Program is planning to provide a shared platform capable of carrying multiple, independent, piggyback-like instruments in order to offer suborbital flight opportunities to more users. The following table summarizes the standard services and anticipated constraints for a flight supporting about six instruments:

Balloon Altitude:	Flight Duration:	Per instrument Weight/Size:	Data Rate/Power:	Launch location:
30-37 km	6-24 hours	136 kg; 0.4 cubic meters; Standard interface	> 50 kbps LOS; 50-100 watts, regulated 28 V battery nominal	Ft. Sumner (Spring or Fall) Palestine (Summer)

Projects needing unique engineering and/or technical support services, including a flight from Antarctica, and/or vehicles and/or the Wallops Arc-Second Pointing System (WASP), should contact the Balloon Program Office directly for an estimate of the Government Furnished Equipment (GFE) cost of the desired support.

1.2.1.3 *CubeSat Payloads*

CubeSats are described in the *ROSES-**2020** Summary of Solicitation* Section V(**c** ~~b~~)(v). Sizes from 1U to 6U have been launched via the CubeSat Launch Initiative (CSLI) program previously. Recently CSLI has retained a 12U dispenser on contract, so the 12U (2x2x3) form factor is now possible under CSLI and therefore under APRA. However, as stated in the *Summary of Solicitation*, integration and launch services costs must be included in the submitted PI budget.

Following and extending the *Summary of Solicitation* Section V(**c** ~~b~~)(v), the cost of launch to Low Earth Orbit (LEO) for a single ≤ 3U spacecraft will be covered under the CSLI at no cost to the investigation. For this case proposers should merely mention in the budget justification that only the standard CSLI-provided launch services are needed and proposers should not include such launch service charges in the proposal budget. Proposals to go beyond LEO, utilize more than one spacecraft, or involve a CubeSat >3U must contact CSLI representatives listed in the *Summary of Solicitation* to obtain a cost estimate. Proposals must state explicitly in the budget justification that there are additional costs for launch within the proposed budget, and include those costs in the NSPIRES cover page budget. However, such CSLI-quoted launch services costs are not the responsibility of the proposing organization and overhead must not be charged on those costs. As a result of their secondary status, CubeSats are placed into orbits that are dictated by the primary. Therefore, in any given year a finite number of specific orbits (e.g., inclinations and altitudes) will be available for CubeSats, and the types of orbits available will vary from year to year. Thus, CubeSat-based missions requiring very specific orbital parameters may be at a disadvantage for securing a timely launch. Proposals must include a CubeSat Mission Parameters Table (see *Summary of*

Solicitation) and clearly indicate both the required and the acceptable range of orbital parameters needed to meet mission objectives. Both the CSLI-quoted launch service cost and the likelihood of manifesting the CubeSat will be considered in the selection decision.

1.2.1.4 *Special Instructions for Multiple-Institution Proposals for Suborbital/Suborbital-class Investigations*

Proposals for suborbital and suborbital-class investigations often involve the development of payloads that require major hardware collaborations among several organizations. In such cases, the lead Principal Investigator (PI) shall propose a direct subcontracting arrangement between his/her organization and the Co-Investigator (Co-I) organization(s) other than U.S. Government organizations, in which case all the nominal instructions in the *NASA Guidebook for Proposers* (see further below) apply. The activities of Co-Is at U.S. Government organizations, such as NASA centers, are always funded directly by NASA, and thus their portion of the budget must be clearly delineated in the PI proposal budget. If the PI is from a U.S. Government organization, Co-Is will be funded by subawards made from that organization. NASA centers apply no overhead cost to the budgets for Co-I organizations. The proposed budget must explicitly include the funding required for participating Co-Investigator(s) at U.S. Government organizations, including NASA Centers and JPL, unless the effort of those organizations is contributed (in which case a Letter of Commitment is required). Participants on a proposal who are designated as Collaborators by virtue of their foreign institution affiliation but whose contribution is essential to the success of the investigation must provide a Letter of Commitment from their institution. The allowance for "Co-Investigator Proposals" for suborbital and suborbital-class investigations has been removed.

1.2.2 *Detector Development*

This APRA category solicits investigations that either advance our understanding of the fundamental operational aspects of detectors or develop new types of detectors to the point where they can be proposed in response to future announcements of flight opportunities. Either new measurement concepts or methods to improve the performance of existing detectors may be proposed, provided they would be candidates for use in space. Among the characteristics typically desirable in space-quality detection systems are high sensitivity to relevant signals, low mass, low sensitivity to particle radiation, low power consumption, compactness, ability to operate in a vacuum (such that high-voltage arcing is minimized), vibration tolerance, ease and robustness of integration with instrumentation, and ease of remote operation, including reduced transient effects and ease of calibration.

This category does not support development of detectors or instrument subsystems that are intended primarily for ground-based astronomy. However, observing with ground-based facilities may be proposed to verify new detectors or overall system performance, if adequately justified as an integral part of a detector development.

Proposals for new detectors will be evaluated in the context of currently available space astronomy detector technologies. Proposers are encouraged to identify potential

mechanisms that could facilitate transfer of these detector technologies to other users, including Homeland Security, National security, and/or the private sector, for possible application beyond the immediate goals of NASA's programs.

1.2.3 *Supporting Technology*

This APRA category supports investigations of technologies not yet ready for incorporation into new detector or space mission systems, but that offer promise of potential breakthroughs that could lead to future advances in instrumentation useful for NASA's space astronomy and astrophysics programs. This category includes small technology efforts for future NASA Astrophysics missions, such as development of optics, mirrors, coatings, or gratings.

This category also supports proposals for development of new data analysis methods **or other algorithm/software development** for future space missions **(i.e., those not yet listed in Table 1 of the ADAP solicitation in ROSES-2020)**. These proposals should be mission enabling or mission enhancing and directly applicable to future space flight missions, in particular (but not necessarily limited to) those that have been considered in the most recent decadal survey or Astrophysics roadmap. Proposals aimed primarily at carrying out mission concept studies are excluded.

1.2.4 *Laboratory Astrophysics*

The Laboratory Astrophysics category of the APRA program element supports the determination of fundamental atomic, molecular, nuclear, and solid-state parameters that are essential for analyzing and interpreting the data from NASA Astrophysics missions. The category supports both laboratory (experimental) and computational efforts to explore the spectroscopic properties of atoms and molecules and particulate matter, as well as their chemical, physical, and dynamical properties under astrophysical conditions. The resulting data products directly impact our understanding of a wide range of astrophysical phenomena spanning the electromagnetic spectrum, and ranging from the epoch of reionization and the evolution of cosmic structure to the formation and evolution of galaxies, stars, and exoplanetary systems in the current epoch.

Laboratory Astrophysics proposals must be well motivated by a detailed description of the relevance of the proposed investigation to the analysis of measurements from NASA astrophysics missions (past, current, or future). Such proposals pertaining to James Webb Space Telescope (JWST) or the X-ray Imaging and Spectroscopy Mission (XRISM) would be particularly timely. Proposals for projects that aim to produce data products for wide use across the astronomical community should explain how those products would be made available to the intended users in a stable fashion.

Added in APRA-2020: as part of a new laboratory equipment initiative, proposals to the Laboratory Astrophysics category may include a request for upgrades to and/or replacement of laboratory equipment in support of the proposed investigation. To be considered for such support, a one-page justification must be included with the proposal, immediately following the Scientific/Technical/Management section. This justification is not counted against the S/T/M overall page limit. Currently, the limit for such requests is $50k per

proposal total and may be spread across no more than two of the proposed funding years. Equipment requests will only be considered as part of a Laboratory Astrophysics science investigation proposal. Evaluation of the overall proposal will be based on the main proposal with a separate evaluation of the equipment request. Selection of the main proposal will be made on the basis of its merit alone, without the equipment request. The additional selection of the equipment request would then be made on the basis of its merit in (a) improving the outcome or effectiveness of the proposed investigation, (b) its suitability to enable other investigations, and (c) cost reasonableness. Requested equipment costs must be included in the overall proposal budget in the NSPIRES cover sheets. The basis of estimate for the equipment costs must be provided in the Budget Justification section. Since the equipment request is a severable part of the proposal, these costs must be clearly demarcated in the tables provided in the detailed appendices to facilitate the possibility of selecting the main proposal without the equipment request.

2. Programmatic Information

2.1 General Information

The following table provides the amount of Year-1 funding and the number of investigations that have been selected for the four APRA categories in five recent cycles; note that proposals for APRA-14 (denoted A-14) were due in 2015 and funded in FY 2016, etc. If the budget allows, it is expected (but cannot be guaranteed) that the selections in the coming year will be similar.

APRA Category	Total allocated to first year of new selections [$M]					Number of New Selections (excluding Co-I proposals)				
	A-14	A-15	A-16	A-17	A-18	A-14	A-15	A-16	A-17	A-18
Suborbital Investigations	7.3	6.4	6.8	7.9	8.0	10	13	13	9	10
Detector Development	2.6	3.5	4.1	4.6	4.7	11	13	12	14	12
Supporting Technology	1.8	4.0	2.1	2.6	3.0	9	12	7	12	10
Laboratory Astrophysics	1.1	1.6	1.6	1.2	1.2	8	10	11	8	8

Note that the new Laboratory Astrophysics equipment initiative allotment is not included in these selection allocations. Further, absent the appropriation by Congress of funding for the recovery of research from the COVID-19 pandemic, SMD's policy (SPD-36) to prioritize augmentations in support of early career researchers at https://science.nasa.gov/researchers/sara/library-and-useful-links, and the extension of suborbital investigations resulting from flight campaign cancellations, is producing a financial strain that requires accommodations within the research program, *i.e.*, new selections from APRA-2020 may have their

starting dates delayed and/or the number of selections from the APRA-2020 solicitation may be reduced compared to historical norms.

2.2 Student Participation

The participation of graduate students is strongly encouraged, especially if the project can be concluded within the nominal tenure of graduate training. In such cases, brief details of the educational goals and training of the participants should be included in the proposal. Specific factors that will be considered when evaluating a proposal's intrinsic merit include the degree to which it advances the readiness of early-career researchers or graduate students to assume roles in advancing NASA's strategic objectives.

2.3 Request for reviewer names

Proposers are strongly encouraged to provide names and contact information of up to five experts qualified to review their proposal. These experts must not be from the institutions of the PI or Co-Is or stand to benefit financially from the selection (or otherwise) of the proposal. This information should be included in the program specific data question in the Notice of Intent, or emailed to the relevant Program Officer listed below.

2.4 Proposal Submission Requirement: Mandatory NOIs

To facilitate the early recruitment of a conflict-free review panel and ensure that proposals are submitted to the appropriate category, an NOI will be required for all submissions to this program element. Proposals that are not preceded by an NOI will be returned without review. No feedback will be provided in response to the NOI.

After NOI submission, the PI may request to reassign that role only to listed Co-Is, and proposers may request to add funded investigators. The PI must inform the point(s) of contact identified in the summary table of key information and cc sara@nasa.gov at least two weeks in advance of the proposal due date. Additions of funded investigators within two weeks of the proposal deadline require explicit permission from the NASA point of contact. Submission of an NOI does not obligate the proposer to submit a full proposal later.

For Laboratory Astrophysics, please include a statement whether the proposal will include an equipment request (see Section 1.2.4).

2.5 Availability of MSFC X-ray Test Facilities

The X-ray optics facilities maintained by MSFC include the X-ray and Cryogenic Facility and Stray Light Facilities as Agency Capabilities. In the past, PIs wishing to make use of the MSFC Stray Light Facility and/or the X-ray Cryogenic Facility included Co-I funding to MSFC in order to fund this usage. These facilities are now supported for **some of** this work by directed work packages under the NASA Internal Scientist Funding Model, so ~~proposals may no longer need to include this in their budget. For more information~~ **proposers planning to request use of the MSFC facilities should** contact brian.ramsey@nasa.gov **to discuss what portion of the request can be covered by current support and what portion needs to be included in the APRA proposal budget.**

2.6 Clarification of Proposal Content

Rules concerning the preparation and submission of proposals are provided in **four** documents in the following priority order: this program element; **D.1 Astrophysics Research Program Overview;** the ROSES-2020 *Summary of Solicitation*; and the *NASA Guidebook for Proposers*. Proposers should ensure that the most recent versions of these documents are consulted prior to proposal submission as clarifications and amendments are made throughout the year.

~~As the proposals for D.3 APRA and D.7 SAT are submitted simultaneously, it is not necessary to include proposals submitted to either program element in the ROSES-20 solicitation in the Current and Pending section of the proposal.~~

Since, by definition, investigators at foreign institutions are not provided funding and are therefore Collaborators, letters or support are not generally required. However, if the Collaborators at foreign institutions are providing portions of the investigation that are required in order for it to be fully successful, then a letter from an appropriate representative of that institution must be provided that illustrates the institutional commitment to the provision of those required portions.

The application to become a Nancy Grace Roman Technology Fellow (RTF; see program element D.8 of this ROSES solicitation) is a one-page addendum submitted along with an APRA proposal. To be eligible for an RTF, the applicant must be designated as the PI, **or** Science PI ~~or Institutional PI~~ as their proposal role on the APRA cover sheet, and must be shown to have a substantial, leading, and responsible role in the proposal work plan. An applicant on a successful, technology-centered APRA proposal will then be considered for designation as a Roman Technology Fellow based on this one-page application.

2.7 Evaluation Criteria

All proposals with be evaluated for Intrinsic Merit, Cost, and Relevance, as defined in Appendix D of the *NASA Guidebook for Proposers* and consistent with Section VI(a) of the *ROSES Summary of Solicitation* and D.1 the Astrophysics Research Overview (e.g., see Section 1.1 regarding the new requirement for Data Management Plans and Archiving. In addition, for suborbital and suborbital-class investigations (as noted in Section 1.2.1), the evaluation of intrinsic merit will include the degree to which it advances **the technology readiness level of a detector or supporting technology, and secondarily the degree to which it advances** the readiness of early-career researchers or graduate students to assume roles in advancing NASA's strategic objectives.

3. Summary of Key Information

Expected program budget for first year of new awards	See Section 2.1
Number of new awards pending adequate proposals of merit	See Section 2.1
Maximum duration of awards	4 years (5 years for suborbital investigations)
Due date for Mandatory Notice of Intent to propose (NOI)	See Tables 2 and 3 of this ROSES NRA.

Due date for proposals	See Tables 2 and 3 of this ROSES NRA.
Planning date for start of investigation	Typically, October, but allowed between July and December in the year after the proposal due date.
Page limit for the central Science-Technical-Management section of proposal	15 pp (20 pp for suborbital proposals); see also Table 1 of ROSES and the *NASA Guidebook for Proposers*.
Relevance	This program is relevant to the Astrophysics questions and goals in the NASA Science Plan. Proposals that are relevant to this program are, by definition, relevant to NASA.
General information and overview of this solicitation	See the *ROSES Summary of Solicitation*.
Detailed instructions for the preparation and submission of proposals	Please see *ROSES Summary of Solicitation Section 1(g)* Order of Precedence and the *NASA Guidebook for Proposers*.
Submission medium	Electronic proposal submission is required; no hard copy is required or permitted.
Web site for submission of proposal via NSPIRES	http://nspires.nasaprs.com/ (help desk available at nspires-help@nasaprs.com or (202) 479-9376)
Web site for submission of proposal via Grants.gov	http://grants.gov (help desk available at support@grants.gov or (800) 518-4726)
Funding opportunity number for downloading an application package from Grants.gov	NNH20ZDA001N-APRA
Main point of contact concerning this program	Dominic J. Benford Astrophysics Division Science Mission Directorate NASA Headquarters Washington, DC 20546-0001 Telephone: ~~(202) 358-1261~~ **(301)758-9305** Email: Dominic.Benford@nasa.gov

Questions about the APRA Program should be directed to the point of contact above. Questions about specific discipline areas may be directed to the relevant Program Officers listed below, along with their areas of expertise. If uncertain about whom to contact, please direct your inquiries to the APRA point of contact listed above.

NAME	DISCIPLINE RESPONSIBILITY	TELEPHONE	EMAIL
Eric V. Tollestrup	Infrared, Submillimeter, and Radio Astrophysics	(202) 358-0907 **(202) 308-3056**	Eric.V.Tollestrup@nasa.gov
Michael R. Garcia	Ultraviolet and Visible Astrophysics	(202) 358-1053 **(202) 320-6341**	Michael.R.Garcia@nasa.gov

Valerie Connaughton	X-ray and Gamma-ray Astrophysics	(202) 358-1763 **(202) 578-8504**	Valerie.Connaughton@nasa.gov
Thomas Hams	Particle Astrophysics and Fundamental Physics	(202) 358-5162	Thomas.Hams-1@nasa.gov
William B. Latter	Laboratory Astrophysics	(202) 358-0734 **(202) 578-0222**	William.B.Latter@nasa.gov