Developmental Testbed Center (DTC) Terms of Operation

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1 OVERVIEW

The Developmental Testbed Center (DTC) is a distributed facility where the NWP community can test and evaluate new models, technologies, and techniques for use in research and operations. It serves as a bridge between research and operations to facilitate the activities of both halves of the NWP community in pursuit of their own objectives:

- The research community gets a "functionality similar" operational environment that allows testing and evaluation of new NWP methods in retrospective extended period tests using advanced tools
- The operational community benefits from DTC testing and evaluation of strengths and weaknesses of new NWP advances prior to consideration for operational implementation

It is recognized that DTC's efforts include both regional and global aspects of numerical weather prediction.

2 PURPOSE

The purpose of this Terms of Operation (hereafter referred to as the TOO) is to define how the DTC operates. The TOO is a consensus policy describing how the DTC functions and outlines the planning and execution processes to ensure smooth operation of the DTC in a coordinated manner. Elements of the TOO include: DTC goals and guiding principles, governance and oversight, sponsors, DTC activities, Annual Operating Plan (AOP) procedures, annual planning and reporting timeframe, allocation of funding, DTC administration, Global Modeling Testbed, and terms of the TOO.

All DTC participants indicated in this TOO are expected to provide a good-faith effort to fulfill their relevant roles. Current DTC sponsors include the National Weather Service (NWS), Office of Oceanic and Atmospheric Research (OAR), U.S. Air Force (USAF), and the National Center for Atmospheric Research (NCAR). Hereafter referred to as DTC sponsors. The National Science Foundation (NSF) also contributes funds to support the DTC visiting scientist program. Future partners may be included in the DTC, pending their concurrence with the TOO and contingent upon approval by the Executive Committee (EC).

3 GOALS / GUIDING PRINCIPLES

The DTC's goals are to:

- Link research and operational communities
- Speed transition of research results into operations
- Accelerate improvements in weather forecasts
- Develop and test promising new technologies and techniques

- Provide an opportunity for the NWP community to perform cycled or real-time tests of model and data assimilation systems

4 GOVERNANCE AND OVERSIGHT - ROLES AND RESPONSIBILITY

The operations and management of the DTC are governed by a Charter (established in 2009; revised in 2017). DTC activities are primarily carried out at NCAR and National Oceanic and Atmospheric Administration (NOAA)/OAR/Earth System Research Laboratory (ESRL)/Global Systems Division (GSD). The DTC management and operation are governed by a hierarchical structure of boards and committees whose members represent the interests of the sponsors and the broader NWP community.

Day-to-day management of the DTC is provided by a four-member team consisting of the DTC Director, an Assistant Director, and Deputy Directors from NCAR and OAR/GSD. The Executive Committee (EC), which is comprised of representatives from each DTC sponsor, governs and provides executive oversight for the DTC, with current membership from NOAA/OAR, NOAA/NWS, NCAR, and the USAF. The Management Board (MB), comprised of two representatives from each of the sponsors, assists the DTC Director in the preparation of the AOP and annual budget, selection of code/technologies/techniques for testing, and review of proposals for multi-year testing and evaluation of projects. The DTC Science Advisory Board (SAB), consisting of scientists and experts from the academic and operational NWP communities, provides perspective on the latest NWP technologies and long-term trends. The DTC SAB also provides insight on new NWP technologies for DTC testing and DTC visitor projects. DTC management provides representation on the NOAA Testbed and Operational Provide Ground Coordinating Committee.

More specifically, the roles of the Science Advisory Board, DTC Director, Executive Committee, and Management Board, are described below.

4.1 Science Advisory Board (SAB)

The DTC SAB is a non-Federal Advisory Committee Act (FACA) body, comprised of scientists and experts from the academic and operational NWP communities, to gain an understanding of the scientific activities underway at the DTC in order to provide valuable insight on the scientific relevancy of those activities with respect to the current state of science. Each appointment to the SAB is valid for three years and is subject to concurrence of the EC. SAB membership appointments are recommended by the MB and are subject to approval by the EC. SAB members are responsible, annually, for selecting their own chairperson to facilitate its business and reporting.

The DTC Director considers the current state of science in shaping the strategic direction and objectives of the DTC. Annually, the SAB provides insight on emerging NWP technologies and techniques, strategic computing resource issues, selection of code for testing and evaluation, and selection of potential subject matter expertise for the visiting scientist program. Members of the SAB are expected to consult widely with colleagues in the NWP community with respect to possible near-term and longer-ranging scientific

advances that should be considered by the DTC. SAB members are expected to represent the broader NWP community. The SAB considers reports on the work ongoing at the DTC, the input of invited experts, and other guidance the members bring to the meeting. The SAB meets at least biannually to perform business, with one of these meetings being on-site, typically in September.

Federal agencies will not request or accept consensus opinions, advice or recommendations from the SAB. Instead, SAB members will be invited to provide their individual insight on the scientific direction and merits of DTC activities.

4.2 DTC Director

The DTC Director is appointed by and is accountable to the DTC EC for management of DTC activities. The Director's office is comprised of the DTC Director, DTC Assistant Director, Deputy Director for NCAR, and the Deputy Director for OAR/GSD. The DTC Director may be removed at any time by the EC. Administratively, the DTC Director reports to and is evaluated through the chain of command in their respective center or agency. The Deputy Director for NCAR is appointed by NCAR leadership and is accountable for the NCAR-executed DTC activities. The Deputy Director for OAR/GSD is appointed by OAR leadership and is accountable for the OAR-executed DTC activities. The DTC Director, Deputy Director for OAR/GSD, and Deputy Director for NCAR receive advice from the Associate Directors and the MB. The DTC Director appoints an Assistant Director who will assists the DTC Director on the management of the DTC. The DTC Director and Assistant Director are also responsible for developing the AOP based on prioritized inputs from the DTC sponsors, and the administration of a visiting scientist program.

To facilitate the execution of DTC tasks, the DTC Director may appoint a DTC Task Lead for each specific task area. The primary function of a DTC Task Lead is to coordinate the work being carried out at NCAR and OAR/GSD in a specific task area, in consultation with the operational model developers at the NOAA/NWS' National Centers for Environmental Prediction (NCEP). The DTC Task Leads also assist the DTC Director and DTC Assistant Director in the preparation of the AOP document, presentations at DTC SAB, MB and EC meetings, and DTC reporting. Each DTC staff member has his/her line of supervision in their home institution at NCAR and OAR/GSD. The DTC Task Leads have no authority to assign tasks to staff across institutional boundaries.

To ensure DTC objectives and deliverables are compatible with institution and staff development goals, each Task Lead may be complemented by a Node Activity Coordinator (NAC) at the institution not represented by the Task Lead. The primary role of the NAC is to coordinate resources from the institution. Resource allocation requires active engagement in Task planning and execution at critical times during the AOP. The NAC will play an integral role in Task development and sub-task prioritization during the AOP proposal cycle and during work planning. The NAC is also expected to contribute to reporting, in coordination with the Task Lead, and serve as a general back-up to the Task Lead (e.g. when a Task Lead is on vacation or otherwise unavailable for a meeting). In the event of issues with Task progress, deliverables, or staff performance, the Task Lead will work first with the

NAC to address them. If the Task Lead and NAC are unable to address any issues, they should jointly approach DTC management (Director and Deputies) for resolution.

4.3 Executive Committee (EC)

The EC is comprised of one representative from each sponsor, as determined by each agency's leadership. As new sponsors join the DTC, their respective agencies will provide representation to the EC. The EC is responsible for the selection of the DTC Director.

The EC provides the authority for the operation of the DTC on behalf of the participants. The EC determines the overall policy for DTC, consistent with these Terms of Operation. The EC has the authority to modify the TOO, as needed. The EC receives and decides whether to approve the AOP, Annual Review (AR), and periodic reviews of the DTC. The EC is the final authority for any unresolved management issues referred by the DTC Director, Deputy Director for OAR/GSD, Deputy Director for NCAR or the MB. The EC usually holds one face-to-face meeting annually. The EC may call for meetings as a need arises. At the discretion of the Chair of the DTC EC, a point-of-contact (POC) may be appointed to provide ongoing liaison with the DTC Director in-between meetings.

4.4 Management Board (MB)

The MB is comprised of two representatives from each sponsor, along with the Deputy Director for OAR/GSD, Deputy Director for NCAR and DTC Director. A quorum, defined as the DTC Director, Deputy Director for OAR/GSD, Deputy Director for NCAR, and at least one representative from each of the DTC partners, is required for the MB to conduct its meetings. MB representatives from each agency are determined by the respective agency's leadership. Each agency is permitted to determine the length of tenure of a MB representative.

MB members recommend decisions to the DTC Director on funding visiting scientist proposals. All MB recommendations are to be consistent with other guidance contained in this TOO. If significant modifications are required on an approved DTC task, the DTC Director will seek approval from the MB members of the particular sponsor which funds the task. As part of the AOP planning cycle, MB members are permitted to suggest new tasks for the DTC, as well as recommendations that some existing tasks are no longer warranted. MB members are expected to consult with other relevant NOAA managers and scientific staff. These recommendations should be conveyed to the DTC Director by 1 Nov. Based on joint considerations and each agency's priorities, the MB will work with the DTC Director to prepare the AOP, the DTC annual budget, and any necessary guidance for multi-year projects.

5 DTC SPONSORS

Current DTC sponsors include NWS, OAR, USAF, and NCAR. The NSF contributes funds to supplement the DTC visiting scientist program but does not participate as a full DTC sponsor with representation on the EC or MB. DTC scientific activities currently are executed by

OAR/GSD and NCAR. Other potential partners may be included in the DTC, contingent upon approval by the EC, as noted above. New sponsors will be permitted to assign MB and EC members.

6 DTC ACTIVITIES

The DTC is responsible for the following activities:

- Development, testing, evaluation, and documentation (DTED) of methodologies for improving numerical weather predictions, using modeling systems that are as close as practicably possible to current and/or future operational systems of the sponsors. The scope (regional vs. global, forecast model vs. assimilation system) of DTC activities is intentionally left undefined; which systems are maintained and used may change from one year to the next.
- Maintenance of functionally equivalent operational NWP systems. DTC is responsible to procure, maintain and provide community support for selected NWP systems currently in operations. These NWP systems should be updated and synchronized with the latest version(s) of operational codes, scripts and procedures, and serve as benchmarks for evaluating promising new technologies.
- Management of the end-to-end baseline community software used in the DTED, consisting of contributed codes and reference configurations. Contributed codes are developmental and experimental codes that exist in the code repository. Responsibilities and procedures for managing and supporting the code system to users are documented in the code management plan.
- Support of baseline reference configurations to the NWP community. Reference configurations are a limited number of rigorously tested code versions, drawn or adapted from contributed codes, of primary interest to research and operational applications and supported to the NWP community as the end-to-end modeling system. Operational model configuration will serve as one of the reference configurations (and as a benchmark for validation of new techniques).
- Conduct a visiting scientist program. Pending funding availability and proposal acceptance via procedures, the DTC provides support for scientists to use DTC resources to test new NWP technologies and techniques that could potentially improve existing operational NWP systems.

  An increased scope of DTC activities is allowed, subject to approval by the DTC EC, as described above. Changes in scope will be reflected in changes in this TOO.

7 ANNUAL OPERATING PLAN (AOP) PROCEDURES

Management of the DTC occurs on an annual basis, with each year's activities defined through an AOP. The AOP is prepared by the DTC Director, with input from Task Leads. Each task has an assigned lead responsible for developing the proposed annual task work plan and for ensuring the successful execution of the approved work plan. The AOP is reviewed, revised, and

endorsed by the MB before it is submitted to the EC for approval. The EC is responsible for approving the AOP. The DTC executes the AOP plan once it is approved.

7.1 Initiation of New Proposed Task List for the Annual Cycle

The DTC AOP planning starts in September. In the September timeframe, the DTC SAB convenes and subsequently weighs in on the current state of science as it pertains to DTC activities, based on the materials and information provided to them on: (i) future modeling plans of operational centers, (ii) recent DTC activities and accomplishments, and (iii) DTC's initial thoughts on future activities. DTC management seeks preliminary guidance from sponsors with regards to their priorities for the coming year. The operational centers and MB members are encouraged to propose tasks to the DTC Director's Office for consideration. These tasks should be sent to the DTC Director's Office by 1 Nov.

The DTC Task Leads, in collaboration with the NAC, develop initial draft proposals for possible task activities. These proposals are shared with team leads in operational centers and research labs (i.e., EMC, ESRL, and USAF), and are revised following extensive discussions. The DTC Director's Office develops a draft AOP proposal, including a detailed description and associated budget for each specific proposed task, before the end of December. The draft DTC AOP proposal is then reviewed by the DTC MB for their annual January meeting. The priority rankings for all proposed tasks are established based on the guidance and priorities of the sponsors and the management board deliberation. Based on the discussion of DTC MB, the proposed tasks are separated into three tiers. The first tier is considered the highest priority task and can be funded if the DTC has a budget at 85% of the previous year. The second tier is considered high-to-medium priority, and can be included if the DTC budget falls within 85% to 100% of the previous year. The third tier is considered lower priority, and can be funded only if the DTC has an increased budget beyond that of the previous year. Usually, there is considerable deliberation with regards to the ranking of the second tier tasks, as the final DTC budget often comes in between 85% and 100%. Therefore, the priority ranking will set the 'cut-off' line once the final budget is known.

7.2 Prioritization of Tasks

The DTC MB members are asked to review, suggest revisions to, and ultimately provide a priority ranking to all proposed tasks. The MB members representing a sponsor have significant say on the use of the funds of that particular sponsor. For example, the aggregate priority ranking from NOAA MB members will determine how NOAA funds are used to support DTC tasks. USAF MB members do not vote for the use of NOAA funds, and vice versa. USAF MB members set priority on the use of USAF funds for the DTC tasks. The discussion and deliberation provide an opportunity for collaboration among sponsors, and to ensure all key functions and key tasks of the DTC are funded. It is recognized that the priority of different sponsors may change annually, and adjustments are made each year accordingly. As part of the review, DTC MB members will also use information on proposed task assignments between NOAA and NCAR as part of its review to maintain necessary balance in approximate funding available for each agency.

7.3 Establishment and Tracking of Deliverables Funded By Multiple Sponsors

Tasks that are funded by multiple sponsors are broken into subtasks. A clear description of each specific subtask that is funded by one sponsor and distinct separate deliverables associated with that subtask are documented. There is no 'mixing' of sub-tasks nor deliverables among sponsors. This allows the sponsors to collaborate on a broader task, while maintaining the integrity and accountability of individual funding lines.

7.4 Procedure for Disagreement Among Sponsors Regarding Task Prioritization

The DTC MB is the main governing body to organize the task prioritization according to the priority of each sponsor. The aggregate priority of the MB members of a particular sponsor sets the prioritization for the use of that sponsor's funds. All issues related to funding and prioritization are expected to be resolved by the MB. Unresolved issues will require involvement of the DTC EC. If there is no closure on the use of a particular sponsor's funds, the sponsor represented on the EC will be involved in resolving the dispute. If some key functions of the DTC are not funded, then it will be elevated to the full DTC EC for resolution.

8 ANNUAL PLANNING AND REPORTING TIMEFRAME

DTC activities are reviewed on a semi-annual basis by the MB and on an annual basis by the EC. The DTC SAB also provides insight on an annual basis.

- January
  - The MB is expected to meet in January, with preparation of a draft AOP for submission to the DTC EC by early February.
  - The DTC Director works with Deputy Directors for NCAR and OAR/GSD to provide a cost estimate and scope of work for proposed activities by Jan 1.
- February
  - The EC is expected to meet in February.
  - The DTC Director provides a final AOP proposal to the MB and EC no less than two weeks in advance of the upcoming DTC EC meeting (provisional upon the MB meeting occurring more than two weeks prior to the EC meeting).
- April
  - The DTC management year is assumed to start on 1 April.
- June
  - No later than 60 days after the end of a management year, an Annual Report (AR) is provided by DTC management with sufficient detail on each project to provide a

useful assessment to the sponsors. For projects that will span more than 1 year, the component for a particular year will be described in the AOP and reported on in the AR. Other reports on specific projects may be requested by the sponsors.

- September
  - The SAB is expected to meet in early fall.
- November
  - MB members and operational centers are expected to provide guidance to the DTC Director and possibly suggested DTC activities for the next year by 1 Nov.

9 ALLOCATION OF FUNDING

DTC sponsors include NOAA, USAF and NCAR. Sponsors are responsible for DTC administrative expenses that arise from, or are otherwise related to, their participation in DTC activities.

9.1 Separation of Funding

Though discussions of relative priorities are encouraged in the MB, commensurate with federal regulations, each sponsor will be responsible for making decisions on how funding from their agency will be allocated. No commingling of funding is permitted, according to regulation. If multiple sponsors mutually agree that a DTC task should be funded and it requires more funds than one agency can provide, the task will be split into separate components paid for by respective agencies. The work tasked by each agency will be in close proportion to the amount of funding, and separate deliverables may be established by each sponsor according to their discretion.

9.2 Management Costs

DTC management overhead will be shared between agencies, in proportion with the total amount of funding provided by each agency.

9.3 Selection of Staff

To ensure the most knowledgeable scientists are engaged in DTC activities, sponsors are encouraged to provide recommendations to the DTC Director (who will consult with the DTC Management Team) for the involvement of specific scientists at NCAR and OAR/GSD, though the ultimate responsibility for project execution lies with the DTC Director.

Agencies funding the DTC are expected to sustain it at a level necessary to fulfill its purpose, contingent on the availability of resources.

10 DTC ADMINISTRATION

10.1 Staff Supervision

Performing organizations are responsible for their own staff supervision. When staff are not performing to Task Lead expectations for meeting task deliverables, the Task Lead should work first through the NAC. If issues cannot be resolved between a Task Lead and corresponding NAC, they should be subsequently raised with the relevant Deputy Directors.

10.2 Period of Performance

The period of performance for each AOP is one year. It is equal to the DTC management year beginning on April 1, except in the case of a No-Cost Extension which may be granted to complete unfinished tasks. Sponsor requests for additional work not specified in an approved AOP should be vetted through the DTC Director and Deputy Directors for NCAR and OAR/GSD before committing resources. This ensures all parties understand impacts on AOP tasks, and allows Deputy Directors to reject resource commitment if the risks to funded tasks are too great.

10.3 Remaining Funds at the End of a DTC Period of Performance

Funds remaining at the end of a DTC period of performance are subject to review by the DTC Director. The DTC Director typically recommends a No-Cost Extension to the MB, to complete tasks in an AOP that are not completed by the end of a management year. Completion of unfinished AOP tasks is the first priority for use of unspent funds. A Statement of Work proposing allocation of funds remaining after task completion must be presented to the DTC Director, in conjunction with the MB, within 60 days of the end of the DTC management year allocating those funds.

11 GLOBAL MODELING TESTBED

The Global Modeling Testbed (GMTB) facilitates the R2O process for continued global model development. The Testbed engages the global modeling community by establishing the necessary infrastructure to support distributed development and transition of the most promising innovations into operations. While the GMTB is initially focused on furthering the NWS-funded Next Generation Global Prediction System (NGGPS) initiative, it is envisioned to expand, as other sponsors invest in furthering their respective global modeling priorities through the Testbed.

Each contributing sponsor acts as the sole entity in determining how its funds will be used to support the GMTB and for providing oversight of its funded activities. In collaboration with the DTC Director's Office, each sponsor provides guidance on the development of a Statement of Work (SOW) for funded GMTB activities, based on its global modeling priorities. For example, the NWS / Office of Science and Technology Integration (OSTI) Modeling Program Division, in collaboration with the DTC Director's Office, guides the development of an SOW based on

NGGPS priorities. GMTB tasks are approved separately by each vested partner and are not included in the DTC AOP.

The GMTB period of performance begins on July 1, except in the case of a No-Cost Extension which may be granted to complete unfinished tasks. Requests for additional work not specified in an approved SOW will be vetted through the respective GMTB sponsor (e.g. the NWS/OSTI Modeling Program Division for NGGPS-related activities) as well as the DTC Director and Deputy Directors for NCAR and OAR/GSD, prior to committing resources. Unspent GMTB funds remaining at the end of a GMTB period of performance will be managed in consultation with the sponsor funding the work.

When disagreements arise, the sponsoring office may consult with the EC for advice on GMTB-specific items. Unresolved GMTB issues will be elevated to the sponsor's leadership (e.g. issues related to the NGGPS will be elevated to the Director of NWS).

12 TERMS OF THE TOO

The TOO will be revisited on an annual basis by the MB and approved by the EC. The TOO may be modified, as circumstances warrant.