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CEDAR Community Statement on DYNAMIC and GDC

NASA space missions are essential to the United States' global leadership in understanding, mitigating, and forecasting the impacts of upper atmospheric disturbances on orbital spacecraft and on our increasingly technology-dependent society. The US-led CEDAR[1] community strongly endorses these efforts. More specifically, the CEDAR community concurs with the US National Academies' assessments in 2013 and 2024 that NASA's proposed DYNAMIC and GDC[2] missions will be critical components of this work. DYNAMIC will measure prevailing winds, temperatures, and densities at altitudes from 100-250 km across the globe. GDC, as proposed before its cancellation, would measure key geophysical parameters in the ionosphere-thermosphere system from 300–500 km across different local times. The National Academies' 2013 Decadal Survey[3] confirmed that these data are amongst the highest-ranking observations needed to advance space weather forecasting capabilities. The need for DYNAMIC and GDC was strenuously reaffirmed by the 2020 Midterm Assessment[4], the 2021 Space Weather Gap Analysis Report[5], and the 2024 Decadal Survey[6], which noted that they will "improve the nation's satellite collision avoidance and space traffic coordination capabilities" (p.118). These missions directly address national priorities identified in the FY26 President's Budget Request[7], particularly the strategic focus on space weather and satellite collision avoidance. However, funding to develop these missions is not included in the PBR.

DYNAMIC and GDC observations will address the long-standing and well-recognized observational gap in the low Earth orbit (LEO) and very low Earth orbit (VLEO) region below 300 km altitude, where increasingly crowded space operations require reliable orbital traffic management and space weather forecasting. Both CEDAR and DYNAMIC/GDC seek to understand the response of the LEO and VLEO environment to energy inputs from below (atmospheric waves, tides) and from above (auroral activity, coupling with the magnetosphere, solar irradiance) that change the density that satellites experience on-orbit. This is of vital importance because the space industry can no longer rely on models of the average behavior of the space environment to make accurate predictions of orbital drag. Small errors in drag estimation lead to large uncertainties in predicted satellite paths when an object is moving 17,000 miles per hour. By 2035, there are likely to be well over 100,000 satellites in LEO with a significant number operating below 300 km. By 2035, the US space economy will be worth over $1T. These new challenges must be faced with new observations that map the density of the thermosphere in real time.

DYNAMIC and GDC complement and extend the science of the CEDAR program and align with the 2024 Decadal Survey's emphasis on system science and societal relevance by filling an observational gap in the LEO and VLEO region and enabling the study of multiscale coupling between neutral and ionized components of the upper atmosphere. Variability in the ionosphere and thermosphere directly affects GPS signal accuracy, which is critical for precision agriculture, cell phone navigation, transpolar

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[1] CEDAR is a community of one-to-two thousand US and international scientists. The CEDAR acronym stands for "Coupling, Energetics, and Dynamics of Atmospheric Regions".
[2] The GDC acronym stands for "Geospace Dynamics Constellation". The DYNAMIC acronym stands for "Dynamical Neutral Atmosphere-Ionosphere Coupling".

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airline flight paths, and national defense systems. DYNAMIC and GDC observations will improve the reliability of the radio communication systems, which are widely used during natural disasters, as well as military applications. Improved observations and modeling of upper atmosphere variability will enhance national resilience in navigation, aviation, and communications infrastructure. These observations will serve as input to state-of-the-art space weather forecasting models. As a result, their contributions to orbit prediction, space domain awareness, and space weather predictability will directly support economic growth, national defense, and the long-term usability of the near-Earth space environment. The CEDAR community fully and unequivocally supports DYNAMIC and GDC science and the realization of these missions.

We recognize that NASA must work within the constraints of the federal budget. We also recognize that advancing the DYNAMIC and GDC missions is essential to meeting pressing scientific and strategic priorities. The CEDAR community views DYNAMIC and GDC to be missions of exceptional scientific and strategic value and expresses strong support for their continued advancement. We urge Congress to provide NASA the resources to make these missions a reality. Advancing these missions to launch will affirm hope for a future of scientific advances in the LEO and VLEO regions, help safeguard the American people, and ensure the United States remains globally competitive in space weather prediction.

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[3]National Research Council 2013. Solar and Space Physics: A Science for a Technological Society. Washington, DC: The National Academies Press. https://doi.org/10.17226/13060

[4]National Academies of Sciences, Engineering, and Medicine 2020. Progress Toward Implementation of the 2013 Decadal Survey for Solar and Space Physics: A Midterm Assessment. Washington, DC: The National Academies Press. https://doi.org/10.17226/25668.

[5]NASA 2021 Space Weather Gap Analysis Report:

https://science.nasa.gov/science-pink/s3fs-public/atoms/files/GapAnalysisReport_full_final.pdf

[6]The Next Decades of Discovery in Solar and Space Physics: Exploring and Safeguarding Humanity's Home in Space (2024):
https://www.nationalacademies.org/our-work/decadal-survey-for-solar-and-space-physics-heliophysics-2024-2033

[7]FY26 President Budget Request: https://www.nasa.gov/fy-2026-budget-request/

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