Congressional Budget Office
Cost Estimate

May 31, 2019

At a Glance

S. 881, Space Weather Research and Forecasting Act

As ordered reported by the Senate Committee on Commerce, Science, and Transportation on April 3, 2019

By Fiscal Year, Millions of Dollars	2019	2019-2024	2019-2029
Direct Spending (Outlays)	0	0	0
Revenues	0	0	0
Deficit Effect	0	0	0
Spending Subject to Appropriation (Outlays)	0	235	n.e.

Pay-as-you-go procedures apply?	No	**Mandate Effects**	
Increases on-budget deficits in any of the four consecutive 10-year periods beginning in 2030?	No	Contains intergovernmental mandate?	No
		Contains private-sector mandate?	No

n.e. = not estimated.

The bill would

- Require the National Oceanic and Atmospheric Administration to maintain the capability to observe space weather by building and deploying at least one instrument to capture imagery of coronal mass ejections
- Codify existing multi-agency efforts under the National Space Weather Program

Estimated budgetary effects would primarily stem from

- The costs to acquire a coronagraph, spacecraft, and related equipment

Areas of significant uncertainty include

- The number of spacecraft and coronagraphs required to adequately capture coronal mass ejection imagery
- When the spacecraft and coronagraph would launch and what it could cost

Detailed estimate begins on the next page.

Summary

S. 881 would require the National Oceanic and Atmospheric Administration (NOAA) to capture imagery of coronal mass ejections (CMEs). A CME is a release of a large quantity of matter and electromagnetic radiation from the sun. Currently, the National Aeronautics and Space Administration (NASA) operates several spacecraft that provide imagery of CMEs; however, those vehicles are outdated. S. 881 would require NOAA to assume that responsibility from NASA to ensure that the United States continues to capture images of CMEs.

The bill also would codify existing multi-agency efforts under the National Space Weather Program.

Estimated Federal Cost

The estimated budgetary effect of S. 881 is shown in Table 1. The costs of the legislation fall within budget function 300 (natural resources and environment).

Table 1.
Estimated Increases in Spending Subject to Appropriation Under S. 881

	By Fiscal Year, Millions of Dollars						
	2019	2020	2021	2022	2023	2024	2019-2024
Estimated Authorization	0	20	70	120	25	10	245
Estimated Outlays	0	15	50	95	60	15	235

Basis of Estimate

For this estimate, CBO assumes that S. 881 will be enacted near the end of fiscal year 2019 and that the estimated amounts will be appropriated for each fiscal year beginning in 2020.

Background

Under current law, NOAA is implementing a program that would meet the requirements outlined in S. 881. The Space Weather Follow On (SWFO) program plans to launch two spacecraft in 2024. One will include a coronagraph (a telescope that can capture CME imagery by blocking glare from the sun’s surface), and an instrument that can measure solar wind properties. The second spacecraft will include an additional coronagraph. In NOAA’s plan, those spacecraft would be launched in 2024 as secondary payloads on two currently scheduled launches to minimize launch costs. In 2019, NOAA allocated $27 million to continue implementing the SWFO. Prior to 2019, The agency spent nearly $14 million for the SWFO program.

Spending Subject to Appropriation

Because NOAA has begun to implement the SWFO program, CBO's estimate of the amounts authorized to be appropriated under S. 881 is consistent with the amounts necessary to complete the SWFO program. Using information from NOAA, CBO estimates that securing that capability would cost $235 million over the 2019-2024 period (see Table 1). Those amounts would be used to:

- Acquire one coronagraph and one spacecraft at a cost of $105 million over the 2020-2024 period, and
- Develop, operate, and maintain the ground services that would be used to monitor CME imagery received from the coronagraph at a cost of $130 million over the 2020-2024 period.

CBO expects that acquisition and development of the equipment and necessary ground services would be completed by 2024 and that the coronagraph and spacecraft would be launched as a secondary payload on NASA's currently planned Interstellar Mapping and Acceleration Probe mission in that year.

CBO expects that most of that spending would occur in the years leading up to the launch as NOAA would need to acquire and establish the flight and ground systems necessary to operate the spacecraft well in advance of the launch. CBO also expects that spending prior to the 2024 launch would include amounts for testing the spacecraft and coronagraph to ensure they will function properly once launched. Additional amounts would be necessary in 2024 and beyond in order to operate and maintain the spacecraft, coronagraph, and ground services.

Other provisions in the bill would codify ongoing activities being carried out by several agencies under the National Space Weather Program and the Space Weather Operations, Research and Mitigation Working Group. In 2019, those agencies allocated a combined total of nearly $350 million to activities related to space weather. Because the activities could be conducted under existing authorities, CBO estimates that those provisions would not authorize additional appropriations.

Uncertainty

The uncertainty in this estimate stems largely from the number of space-based and ground-based instruments that would be necessary to provide real-time CME imagery and when spacecraft would be lauched. S. 881 requires that NOAA deploy at least one instrument to capture CME imagery. For this estimate, CBO expects that one coronagraph would be sufficient to capture such CME imagery along with one spacecraft to house the coronagraph and one ground-based observation site to record and analyze the images. However, if

additional equipment were required to adequately capture CME imagery then the costs of implementing S. 881 would be higher.

Pay-As-You-Go Considerations: None.

Increase in Long-Term Deficits: None.

Mandates: None.

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