B.6 HELIOPHYSICS LIVING WITH A STAR SCIENCE

NOTICE: There are four major changes to LWS this year:
(1) The Strategic Capabilities element will not be competed in ROSES-2015.
(2) Large Targeted Science Team proposals, whereby a single large investigation covers the entire breadth of a Focus Science Topic will not be permitted in ROSES-2015. Instead, this call will focus on Focused Science Topics proposals lead by individual Principal Investigators, see Section 3.1.
(3) The Sun-Climate Theme has been subsumed into Section 3.2.1.2
(4) The Cross-Disciplinary proposals that include infrastructure-building elements are solicited, see Section 4.

Proposal submission to all calls in Heliophysics will be done by a two-step process, in which a Notice of Intent is replaced by a required Step-1 proposal. The Title and investigators cannot be changed between the Step-1 and Step-2 proposals. See Section 5 for details.

1. Scope of Program

The goal of NASA's Living With a Star (LWS) Program is to develop the scientific understanding needed for the U.S. to effectively address those aspects of Heliophysics science that may affect life and society. LWS Science solicits proposals for fundamental science that will lead to a physics-based understanding of the integral system linking the Sun to the Solar System, including the impact on the heliosphere, planetary magnetospheres, and ionospheres.

Achieving an understanding of those aspects of the Sun-Solar System that have direct impact on life and society behooves the LWS program to tackle strategic large-scale problems that cross (traditionally separate) discipline and technique boundaries (e.g., data analysis, theory, modeling, etc.).

LWS Science is a crosscutting initiative that addresses the following LWS strategic goals (in no priority order):

1. To deliver the understanding and modeling required for useful prediction of the variable solar particulate and radiative environment at the Earth, Moon, Mars, and throughout the solar system;
2. To deliver the understanding of how and to what degree variations in the solar radiative and particulate output contribute to changes in global and regional climate over a wide range of time scales;
3. To deliver the understanding and modeling required for effective forecasting/specification of magnetospheric radiation and plasma environments; and
4. To deliver understanding and predictive models of upper atmospheric and ionospheric responses to changes in solar electromagnetic radiation and to coupling above and below.

These strategic goals, which are expounded on further at the LWS website (http://lwstrt.gsfc.nasa.gov/), provide the basis for the selection of topics for this solicitation. The

primary goal of the LWS Program is to make progress in understanding the complex Heliophysics system, focusing on the fundamental science of the most critical interconnections.

As a result of its defining studies and recommendations, the LWS Science program has defined a strategy with three parts, namely, Strategic Capabilities, Targeted Investigations, and Cross-Disciplinary Infrastructure Building programs.

Further background material concerning relevant research objectives can be found on the LWS website, and in the following documents:

- The latest *TR&T Steering Committee Team Report* (http://lwstrt.gsfc.nasa.gov/trt_steeringcom.htm);
- The National Research Council Decadal Survey Report *Solar and Space Physics: A Science for a Technological Society* (http://www.nap.edu/openbook.php?record_id=13060).

2. Strategic Capabilities

NOTICE: The Strategic Capabilities element will not be competed this year. In its previous guise as "Living With a Star Targeted Research and Technology: NASA/NSF Partnership for Collaborative Space Weather Modeling," it is fully subscribed this year with awards from ROSES-2011 and will not be recompeted until ROSES-2016, at the earliest.

3. Targeted Investigations

The stated goal of LWS, that of achieving an understanding of those aspects of the Sun-Solar System that have direct impact on life and society, poses two great challenges for the LWS program. First, the program must tackle large-scale problems that cross discipline and technique boundaries (e.g., data analysis, theory, modeling, etc.); and second, the program must identify how this new understanding will have a direct impact on life and society.

The Targeted Investigations element this year consists of two Focused Science Topics (FSTs).

3.1. Focused Science Topics

The Focused Science Topics (FST) permitted as the objectives for proposals to this LWS Science solicitation are as follows:

1) Space Weather at Terrestrial Planets: Comparative Climatology
2) The Solar-Stellar Connection

NASA desires a balance of research investigation techniques for each Topic, including theory, modeling, data analysis, observations, and simulations. In 2013 and 2014, proposals could be individual proposals that would form part of a team, or Targeted Science Teams (TSTs), that form prior to selection under a single PI and submit a single TST proposal that attacks the entire

breadth of the Focus Science Topic. However, such TSTs will not be permitted in ROSES-2015. Instead, LWS Science will adopt one of the recommendations in Chapter 10 of the 2013 Heliophysics Decadal Survey that NASA "work toward doubling the size of Individual-Principal-Investigator grants." Given the strategic nature of LWS, and the fact that strategically feasible tasks require sufficient investment, it is anticipated that FST proposals will be in the range of $250K – $300K. (This includes fully encumbered Civil Servant labor, where appropriate.) It is left to individual Principal Investigators (PIs) to decide whether a strategically feasible award size could be achieved by increased collaborative efforts, greater full-time equivalent (FTE) of investigators, or a mix of the two. PIs should be cognizant, however, that given the submission of proposals of adequate number and merit and investigative techniques, up to *four* selections will be made for each Focused Science Topic.

Once selected, these investigators will form a team in order to coordinate their research programs. Due to the collaborations that will arise from coordination of the team research efforts the expected duration of FST awards is four years. One of the PIs will serve as the Team Leader for the Focused Science Topic for which he/she proposed, and will receive supplemental funding, as necessary, to support costs associated with these duties after the selection process is completed. Proposers are encouraged to propose to act as a Team Leader and, if they do so, should include a brief section in their proposal describing how they would lead the team effort. Up to one extra page in the proposal is allowed for this proposed effort. All proposers for Focused Science Topics should include sufficient travel funds in their proposed budgets to cover two team meetings per year to be held on the U.S. coast furthest from their home institutions. See Instructions for LWS Focus Team Members and Leaders at (http://lwstrt.gsfc.nasa.gov/trt_focusteams.htm) for full details of responsibilities.

3.1.1 Space Weather at the Inner Planets

NASA and other space agencies have begun to expand their research into the solar system. Probes are now orbiting or en route to Mercury, Venus, Mars, the outer planets and other bodies in the solar system. With the recent availability of comprehensive solar spectral measurements at X-ray and ultraviolet (XUV) wavelengths, together with development and advancements in first-principles modeling of planetary atmospheres, quantification of the many ranges of solar effects on neutral and ion composition and dynamics of planetary atmospheres is now possible.

The goal of this Focused Science Topic is to develop understanding of the complex response of various planets (excluding Earth) to solar forcing at various time-scales to understand the relative importance of solar driving of these planetary atmospheres and of the implications for the historical and future evolution of the planetary climates. We presently have unprecedented observations of solar spectral variability and of terrestrial planetary atmospheres, which respond to the highly variable solar irradiance and interplanetary CME (ICME) impact. Observations of planetary atmospheres for different phases of the solar cycle and for sporadic events are available through various NASA missions, as well as from ground-based observatories. We also now have modeling capabilities to explore the complex interactions and responses throughout the affected portions of atmospheres to the inputs. Additionally, the long-term variation of these drivers could address planetary atmosphere response on climatological and evolutionary timescales.

3.1.1.1 Goals and Measures of Success

The primary goals of this focused science topic are to improve modeling and characterization of response of various terrestrial planetary environments to varying solar output. Successful investigations will improve quantitative understanding of the complex response of terrestrial planetary atmospheres to solar irradiance temporal and spectral variation. Progress will also be made in understanding what other factors might control the response to solar forcing, such as prior conditioning of the atmosphere. Additionally, a major goal is the use of current observations to validate and calibrate models and allow these models to explore historical and climatological trends.

3.1.1.2 Types of Investigations

The group will consist of modelers of solar irradiance and particulate output, solar and planetary observers, and theorists. Substantial progress on this Focused Science Topic is envisioned with the following (non-exhaustive) investigations:

- New observations and characterization of the solar irradiance environment at a terrestrial planet, in the atmosphere, and/or at the planet surface.
- Numerical models of terrestrial upper atmospheric and surface responses to a full range of solar irradiance inputs.
- Integration of observations of actual impulsive inputs and atmospheric models, combined with models, to establish the complex response function and its sensitivity to input and boundary parameters.
- Coordinated studies of interplanetary modeling of solar irradiance observations.
- Complementary studies of modeling ICME impact on terrestrial planets and their atmospheres.
- Validated models to explore and to quantify whether longer-term variations in these rapid-timescale phenomena contribute to climate variability.

3.1.2 The Solar-Stellar Connection

Solar dynamo forecasting, even for a single cycle, is of practical significance, because it yields predictions of average space weather similar to seasonal forecasts of terrestrial weather. Equally important, solar cycle predictions yield forecasts for Total Solar Irradiance (TSI), a crucial, although not the dominant driver in global climate simulations. Solar dynamo models have grown very sophisticated in recent years, but despite that different simulations have led to very different predictions for the upcoming solar cycle. Hence, we have to look at ways to improve our predictive capability.

A fundamental limitation of current dynamo models is that they are calibrated versus just a single star, the Sun. A dynamo code that captures the essential physics of the dynamo mechanism should be able to reproduce the cyclic activity of other Sun-like stars. The calibration of such simulation codes versus cycle observations of other cool stars is now possible, since we have decades worth of data on the cycle duration and amplitude of these stars from Mount

Wilson and Lowell Observatory, as well as on their starspot coverage and surface differential rotation, and also their flares and CME-like eruptions from other sources.

The calibration of dynamo codes versus stellar data requires basic input data from these stars, such as radius, rotation rate, depth of convection zone, and any information that can be obtained regarding differential rotation. Most of this information is available and more is becoming available right now through from two current asteroseismology missions, CoRoT and Kepler. With this information stellar dynamo codes will produce a prediction for magnetic flux and its distribution over latitude as a function of time, in particular cycle length and amplitude.

It is well known that the Sun through its history has gone through many low activity periods like the Maunder minimum, yet current dynamo models have great difficulty reproducing such global minima, let alone predicting them. A small class of very inactive low variability stars has been identified as possible Maunder minimum candidates. Finding more of these, and detailed studies of their properties, will shed light on the physical underpinnings of global minima and help dynamo modelers incorporate their basic physics and simulate them.

This cross-disciplinary activity is not new, but new investment is timely. Results from Kepler and other experiments have revealed accurate critical parameters for many Sun-like stars. Spectroscopy and photometry reflecting magnetically induced variations now span several decades for the Sun and several well-observed stars. Continued and expanded observation programs will have broader impacts in stellar rotational evolution, the solar-terrestrial connection, space weather, and astrobiology, providing important constraints for diverse theoretical models.

3.1.2.1 Goals and Measures of Success

The overall goal is acquiring a better understanding of the basic physical ingredients of the solar dynamo, including those that cause global activity minima in order to improve the predictive capabilities of current dynamo models. The criteria for success of this focus group are a) progress in the physical understanding of the dynamos of solar-type stars, and b) in the predictive capabilities of the codes that simulate them. Success would be demonstrated by achieving one or both of the following objectives:

- From comparative dynamo simulations for other solar-type stars show how key characteristics of the dynamo cycle depend on basic stellar parameters.
- Find whether a trigger for solar global minima exists, and if so, what it is.

Note that this proposed solar-stellar connection focus completely reverses the current paradigm of solar-stellar research. Here we do not use information from the Sun to understand better other cool stars, but instead we will use information gleaned from other Sun-like stars to obtain a better understanding of the magnetic activity of the Sun -- which is a focus of the LWS program is about.

3.1.2.2 Types of Investigations

The group will consist of dynamo modelers, data miners, solar and stellar observers, and theorists. Substantial progress on this Focused Science Topic is envisioned with the following (nonexhaustive) investigations:

- Dynamo simulations for solar-type stars, calibrated by available observations on cycle periods and amplitudes, starspot evolution and differential rotation, latitude distribution of activity, asteroseismic properties, stellar flare and CME activity.
- Observational studies to determine basic parameters for activity cycles of Sun-like stars from archival data and currently operating missions.
- Studies of Maunder-like minima in stars and in the Sun, both through dynamo modeling and analysis of pertinent stellar and solar data.
- Establish the path of solar evolution, including its activity. Did the Sun have 'superflares' like some early Sun-like stars, and if so, what were their space environment consequences, including analogs of current-day solar winds, CMEs, and solar energetic particles?
- Development of new diagnostics for solar-stellar activity comparisons, especially for early "Suns".
- Studies of cyclical variation of Sun-like stars, through chromospheric proxies or flaring, to study many realizations of "the solar experiment" under conditions of varying age, mass, metallicity, convection zone, and rotational properties.
- Theoretical investigations or numerical models explaining the difference between the dynamos of stars on the "I" and "A" branches of the Böhm-Vitense diagram, and why the Sun appears to (anomalously) lie alone between the branches.
- Development of a (new) homogeneous database of solar-stellar observations – a "VSSO," so to speak, so that the community at large may continue to study the solar-stellar connection after the conclusion of this four-year FST.

3.2. LWS Support for SCOSTEP/ VarSITI International Program

The Scientific Committee on Solar Terrestrial Physics (SCOSTEP) has launched its new scientific program (Variability of the Sun and Its Terrestrial Impact 2014-2018 (VarSITI)) which is an international interdisciplinary research initiative. The international collaboration is the key element in these projects and can significantly enhance NASA/LWS scientific return by bringing in ongoing international effort and expertise to US investigations. The following are four major themes being pursued by VarSITI:

- Solar Evolution and Extrema (SEE);
- International Study of Earth-Affecting Solar Transients (ISEST)/ MiniMax24;
- Specification and Prediction of the Coupled Inner-Magnetospheric Environment (SPeCIMEN); and
- Role Of the Sun and the Middle atmosphere/thermosphere/ionosphere In Climate (ROSMIC).

Many of the research themes of VarSITI are already being addressed by the ongoing efforts in the LWS TR&T program. Based on the needs of the LWS TR&T program and other ongoing efforts in LWS, we will support three of the themes (1, 3 & 4) of VarSITI in ROSES-15:

3.2.1 Types of Investigations

3.2.1.1 Solar Evolution and Extrema (SEE)

Solar variability underpins all of the LWS strategic goals

- What is the expectation for cycle 25? Are we at the verge of a new grand minimum?
- Does our current best understanding of the evolution of solar irradiance and mass loss resolve the “Faint Young Sun” problem?
- For the next few decades, what can we expect in terms of extreme solar flares and storms, and also absence of activity?

So that the user/operational communities can directly benefit from LWS scientific developments, upon selection, the LWS Program Officer will contact relevant modeling centers to identify liaisons to appropriate user/operational communities with respect to development of Cycle 25 (and beyond) predictions.

3.2.1.2 Specification and Prediction of the Coupled Inner-Magnetospheric Environment (SPeCIMEN)

SPeCIMEN’s desire for "quantitative prediction and specification of the Earth’s inner magnetospheric environment based on Sun/solar wind driving inputs" meshes well with the LWS strategic goal to "deliver the understanding and modeling required for effective forecasting/specification of magnetospheric radiation and plasma environments." As such, particular emphasis will be placed upon proposals that:

- Understand how the inner magnetosphere responds as a coupled system to Sun/solar-wind driving;
- Improve predictive models and further develop theoretical models, with a view to integration;
- Couple related models that quantitatively predict the dynamical evolution of the inner magnetospheric state (radiation belts, ring current, cold plasma distribution, plasmasheet, convection electric field, etc.); and
- Couple or fuse predictive and physical models

Proposals that anticipate relying on data from NASA’s upcoming Magnetospheric Multiscale Mission (MMS) will not be considered compliant under this theme. The appropriate venue for such ideas is the expected MMS-specific Guest Investigator opportunity in future ROSES. Similarly, purely model development efforts are more appropriate for the Grand Challenge Research call.

3.2.1.3 Role Of the Sun and the Middle atmosphere/thermosphere/ionosphere In Climate (ROSMIC)/ LWS Sun-Climate Theme

The LWS Sun-Climate strategic objective to "deliver the understanding of how and to what degree variations in the solar radiative and particulate output contribute to changes in global and regional climate over a wide range of time scales" directly supports the above VarSITI theme and, therefore, is subsumed under this topic. Particular emphasis will be placed upon:

- Coupling of the upper and lower atmosphere and the processes responsible for transmitting solar variations to the Earth's surface where they can affect *regional climate.*
- Atmospheric responses on time scales of seasons to millennia and relative importance of solar irradiance versus energetic particles are of primary interest.

Only investigations of Sun-climate issues will be considered compliant under this theme; climate investigations that are not directly relevant to solar forcing are not being solicited.

The VarSITI elements are not Focused Science Topics; there is no expected FST team contribution for awards, and the maximum duration of awards resulting from this element are for three years only (also in keeping with the 2014-2018 timeframe of VarSITI). However, proposals will be judged for compliance based on their (demonstrated) relevance to the SEE, SPeCIMEN or ROSMIC themes. It is nevertheless anticipated that selected PIs will collaborate and share their models and results with each other and the international VarSITI project leaders.

4. Cross-Discipline Infrastructure Building Programs

One of the major challenges facing the LWS Program is to foster an interdisciplinary research community that can cut across traditional discipline boundaries to solve system science problems that are central to understanding and modeling the Sun-Solar System connection. The LWS program is soliciting proposals for one or more investigations to help NASA meet this challenge by promoting interdisciplinary research and development of skills to foster it. It is the expectation of LWS that the resulting award(s) will enhance and facilitate a Heliophysics community composed of diverse sub-disciplines. In order to address this challenge, proposals to this LWS program element may include infrastructure-building elements (e.g, see Final Report of the LWS TR&T Science Definition Team), such as but not limited to, summer schools, postdoctoral fellowships, community workshops implementing the proposed investigation consistent with LWS research goals and objectives. LWS envisions that any award(s) that include such methods and approaches to facilitate the community working together would be guided by a steering committee composed of both community and NASA scientists in the LWS area.

5. Submission and Evaluation Process

5.1 Step-1 Proposals

To streamline the proposal process (submission, evaluation, and administration), this program uses a two-step proposal submission process (see the overall description of a two-step process in the *Summary of Solicitation Section IV. (b) vii*). Proposers should refer to the "Instructions for

Submitting a Step-1 Proposal" under "Other Documents" on the NSPIRES page for this program.

A Step-1 proposal is required and must be submitted electronically by the Step-1 due date (see below and Tables 2 and 3 in the *ROSES Summary of Solicitation*). The Step-1 proposal must be submitted by an Authorized Organizational Representative (AOR) of the PI's institution. No budget is required. Only proposers who submit a Step-1 proposal are eligible to submit a full Step-2 proposal. Full proposals must contain the same scientific goals proposed in the Step-1 proposal. The Step-1 proposal title, Principal Investigator, and all Co-investigators, collaborators, and consultants cannot be adjusted between the Step-1 and Step-2 proposals. The expected format is described below. Submission of the Step-1 proposal does not obligate the offerors to submit a Step-2 (full) proposal later, but all who submit a compliant Step-1 proposal will be invited to submit a corresponding Step-2 proposal.

5.1.1 Step-1 Proposal Format

The Step-1 proposal is restricted to one page in length. It should include the following information:

- A description of the goals and objectives to be addressed by the proposal.
- A brief description of the methodology to be used to address the goals and objectives.
- A brief description of "Proposed Contributions to the Focus Team Effort" (or relevance to LWS Cross-Discipline Infrastructure Building goals and elements of VarSITI themes).

The NSPIRES system for proposal submission requires a very brief summary to be entered into the "Proposal Summary" field and it requires a PDF "Proposal Attachment", which should be the Step-1 proposal. Proposals will be checked to ensure that the text is compliant with the program element indicated (i.e., relevant to only the specified topics, with "Proposed Contributions" addressed).

5.2. Step-2 Proposals

A Step-2 (full) proposal must be submitted electronically by the Step-2 due date (see below and Tables 2 and 3 in the *ROSES Summary of Solicitation*). The Step-2 proposal must be submitted via NSPIRES by the organization Authorized Organizational Representative (AOR). A budget and other specified information is required. The Step-2 proposal title, Principal Investigator, and all team members must be the same as those in the Step-1 proposal. Step-2 proposals must contain the same goals proposed in the Step-1 proposal.

Proposers must have submitted a Step-1 proposal to be eligible to submit a Step-2 proposal. Proposers that have received a noncompliant letter are not eligible to submit a Step-2 proposal.

5.2.1 Step-2 Proposal Format

Guidelines for submitting Step-2 full proposals are specified in the *NASA Guidebook for Proposers*. The criterion for relevance includes relevance to one of the two Focused Science

Topics (Sections 3.1.1–3.1.2) as an essential requirement for selection. As such, NASA has instituted a compliance check as follows:

In order to be compliant to this ROSES element, each FST Step-2 proposal submitted must contain a section, which must be entitled “Proposed Contributions to the Focus Team Effort” and be identified in the proposal's table of contents. Failure to include this section will result in the proposal being judged noncompliant, and the proposal will be returned. This section must include the following three items:

- The relevance of the proposal to the scientific objectives of the Focused Topic.
- The potential contributions (e.g., data sets, simulation results, understanding of physical mechanisms, etc.) from the proposed effort to the Focused Science Team's effort.
- Metrics and milestones for determining the successful progress and outcome of the proposed research.

The *NASA Guidebook for Proposers* states, “NASA strongly encourages PIs to specify only the most critically important personnel to aid in the execution of their proposals.”

5.2.2 Step-2 Evaluation Criteria

Step-2 proposals that are not compliant with format requirements in Section IV (b) *ii* of the *ROSES Summary of Solicitation* and the *NASA Guidebook for Proposers* may be rejected without review.

Compliant proposals will be evaluated according to the criteria specified in Section C.2 of the *NASA Guidebook for Proposers*. These criteria are intrinsic scientific and technical merit, relevance to the NASA’s objectives and those of the FST, which includes cost realism/reasonableness.

For Focus Science Topics described in section 3.1, in addition to the factors given in the *NASA Guidebook for Proposers* each proposal submitted must contain a section, entitled "Proposed Contributions to the Focus Team Effort" and it must be identified in the proposal's table of contents. Failure to include this section will result in the proposal being judged noncompliant, and the proposal will not be reviewed.

Relevance is dependent on the particular Focus Science Topic. Each proposal must demonstrate that the investigation is appropriate for the FST selected. This criterion will be strictly enforced. The appropriate scale of the effort in terms of manpower will also be considered in considering the relevance of FST proposals.

NASA will establish one review panel per element. Named Co-Investigators (who are not PIs on other proposals in the same element) should expect to be called on to provide external ("mail-in") reviews for two to four proposals for that element. External reviews provide review panels with access to vital in-depth expertise and they are critical to the integrity of the review process. Simply being an investigator on a proposal submitted to the H-LWS program solicitation does not automatically constitute a conflict of interest and relief of obligation. (A proposal that is

mistakenly sent to review that does include a PI/Co-Is from the same organization would, however, be an inappropriate conflict of interest).

6. Award Types

The Heliophysics LWS Science program will primarily award funds through three vehicles: (1) grants, (2) interagency transfers, and (3) awards to NASA centers. This call will not award contracts, as it is not appropriate for the nature of the work. Please also see the *ROSES Summary of Solicitation,* Section II (a).

7. Summary of Key Information

Expected annual program budget for new awards	$3.5 M. See also Section 3.1
Number of new awards pending adequate proposals of merit	~20
Maximum duration of awards	Focused Science Topics: 4 years SCOSTEP/VarSITI : 3 years Infrastructure: 5 years
Due date for Step-1 proposals	See Tables 2 and 3 in the *ROSES Summary of Solicitation*.
Due date for Step-2 proposals	See Tables 2 and 3 in the *ROSES Summary of Solicitation*.
Date for start of investigation	No earlier than October 1, 2015.
Page limit for the central Science-Technical-Management section of proposal	15 pp; one extra page permitted for proposals to be Team Leader of a Focused Science Topic, two extra pages are permitted for Cross-Discipline Infrastructure Building proposals; see also Chapter 2 of the *NASA Guidebook for Proposers*
File size limit for the proposal	10MB
Relevance	This program is relevant to the Heliophysics questions and goals in the NASA Science Plan. Proposals that are relevant to this program are, by definition, relevant to NASA. See Section 5.2.2
General information and overview of this solicitation	See the *ROSES Summary of Solicitation*.
Detailed instructions for the preparation and submission of proposals	See the *NASA Guidebook for Proposers* at http://www.hq.nasa.gov/office/procurement/nraguidebook/.
Submission medium	Electronic proposal submission is required; no hard copy is required or permitted. See also Section IV of the *ROSES Summary of Solicitation* and Section 3.3 of the *NASA Guidebook for Proposers*.
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	NNH15ZDA001N-LWS
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