



Spitzer Space Telescope Warm Mission Observing Rules

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Date	Version	Author	Description
2014 September 17	2.2	Elena Scire	Updated moving target overheads in section 1
2010 January 22	2.1	Lisa Storrie-Lombardi	Updated commensurate with issuance of Cycle-8 Call for Proposals. The requirement that generic fixed targets have positions specified to within 2 degrees is deleted. The slew overhead is reduced from 215 to 180 seconds. The definition of Second Look observations has been deleted as they are not supported as part of warm mission proposals.
2010 January 22	2.0	Lisa Storrie-Lombardi	Updated commensurate with issuance of Cycle-7 Call for Proposals.
2008 July 7	1.0	Lisa Storrie-Lombardi	Initial version. Modified from version 8.0 of the cryogenic mission Observing Rules.

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These observing rules pertain to all science observations made with the Spitzer Space Telescope during the warm mission, unless explicitly stated otherwise.

1 Definition of Science Observing Time

All of the wall-clock time required for the execution of a specific observation, by means of an Astronomical Observation Request (AOR), will be charged to that particular AOR. This assessment of observing time starts with the beginning of the sequence of events associated with the AOR and continues until the completion of the events in that AOR. Assessed time shall include all science integration time, readout time, internal calibrations, and routine instrument/spacecraft motions embedded within the AOR.

In addition, overhead is assessed with each AOR in order to distribute the time used for necessary Observatory activities among all science observations. Each AOR will be assessed 180 seconds to account for telescope slew time, regardless of the actual time utilized. Moving target AORs are assessed an additional 210 second overhead to account for the additional commands required to schedule moving targets. The algorithm used to calculate observing time, including standard overheads, is integrated into the software time estimators that scientists use in planning observations. Overhead burdens are reevaluated from one observing cycle to another.

Target of Opportunity (ToO) observations requiring activation less than eight weeks prior to execution will be assessed an additional overhead burden (§5.1). This overhead reflects the lost observing time that was allocated to other programs if the observations are executed, and will be factored into the proposal review. Proposals *must* include these overheads in the total requested observation time.

The total observing time assessed to a program shall consist of the sum of observing times for each of its constituent AORs, including applicable overhead burdens.

Note that Observatory engineering, calibration and telemetry activities are functions of the SSC, and the wall-clock time required to perform these functions is accounted for separately from the science observing time. Any estimates of General Observer time published as part of a *Call for Proposals* will refer to the science observing time, and will be derived after adequate time for facility activities is reserved.

2 Duplicate Observations

In order to ensure the most efficient use of the Spitzer Space Telescope, proposed observations that duplicate those already executed or approved for execution (and therefore in the Science Operations Database) are not permitted without the explicit approval of the SSC Director, or designee. Archival data should be used whenever possible to accomplish the science goals of any proposed investigation.

2.1 Definitions

Given the large number of Spitzer observations annually (> 20,000), it is important to define quantitative thresholds which permit automated checking of AORs to identify candidates for duplication. Two or more observations are considered to be potential duplicates when, for a given channel, the following criteria are met.

1. The integration time per pixel for each observation agrees to within a factor of four (corresponding to a factor of ~two in sensitivity).
2. The areas on the sky covered by two proposed imaging observations overlap by more than 25% of either of the fields/areas being compared. Note that for very large programs, an area overlap of less than 25% could still translate into a significant amount of Spitzer observing time. Observations with area overlaps less than 25%, but greater than 10 hours of observing time, will receive additional scrutiny by the SSC and may be disallowed by the SSC Director.

Note that a lengthy observation within the same observing proposal may be segmented into multiple AORs because of operational constraints, and that the series of component observations are not deemed to be duplicates.

Newly proposed observations that are identified to be potential duplicates must be approved by the SSC Director. Approval will be contingent on a legitimate scientific justification for carrying out the new observations. Examples of observations that may be approved include: synoptic observations of time-variable phenomena and second-epoch (or later) observations searching for transient phenomena. Another example includes a large-area survey, where excising (“cutting out”) a small area to avoid overlap with a previously cataloged observation is so inefficient that it increases the observing time for the affected observation. Finally, a proposed observation resulting from an evolution of the Spitzer AOTs and which leads to a demonstrably better observation strategy for a particular science goal will be considered for approval.

If a new candidate observation is less sensitive than a previously accepted observation and if it meets the area overlap criterion above, it will always be considered a duplicate since the science objective of the new program can be achieved using the deeper observation.

2.2 Procedures

It is the responsibility of any investigator to avoid proposing duplicate observations, apart from the exclusions listed in this sub-section. Each Call for Proposals is accompanied by a comprehensive list of targets and AORs previously approved (§3.2). All previously approved and executed observations can also be queried using *Leopard*, the SSC Archive software. Any newly proposed AOR meeting the criteria listed in §2.1 would be deemed a potential duplicate observation.

It is the responsibility of Principal Investigators of existing approved programs to check the Reserved Observations Catalog released after each completed proposal cycle to determine if any newly approved observations are duplications of any part of their program(s). The SSC should be alerted if any duplications are found.

One exception to the duplicate observation policy described in §2.1 is the case where a series of observations of the same target are intended to search for time-variable phenomena. In this case, a single observation of the same area of the sky will not disallow the time-series observations. On the other hand, if the time-series observations occur *before* the single observation, it may

disallow the single observation (since the objectives of the single observation could be achieved by using data from the time-series observations).

Previously accepted observations (i.e., AORs already entered into the Science Operations Database, or SODB) will always take priority over newly proposed observations. A new or modified AOR that is found to be a duplicate of an existing AOR cannot be entered into the SODB without special permission granted by the SSC Director. To be granted this dispensation, the investigator who stands to lose a proposed duplicate observation must file a request to the Director, describing why the AOR already entered in the SODB cannot be utilized in the proposed investigation. Basing a request solely on the time lag associated with gaining access to data from an existing AOR (whose observation may not yet have been executed and whose data may not enter the public domain until proprietary rights expire) will be insufficient, unless such a delay will significantly compromise the timing and integrity of the proposed investigation. [Affected investigators can always contact the Principal Investigator of the original AOR to seek access to the required data.]

Investigators must describe their observations unambiguously by completing AORs. In general, the TAC shall not recommend observations that duplicate approved observations from a previous Cycle. The final program for a Cycle recommended by the TAC and approved by the SSC Director may include programs with intra-Cycle duplications. These observations will in general be executed by the SSC as approved.

The SSC Director shall have final authority to either allow or disallow duplicate observations.

3 Declaration of AORs

As a general rule, the earliest description of an approved observation -- via completion of a valid Astronomical Observation Request (AOR) -- shall reserve priority rights in the case of duplication(s).

3.1 Definition of Approved Programs

For General Observer (GO) investigations, the approved programs will consist of abstracts and either of the following: (i) all of the original AORs submitted as part of a GO proposal that has been accepted without any modifications recommended by the TAC, or (ii) a revised list of AORs that has been modified in response to specific TAC recommendations.

For Director's Discretionary Time (DDT) observations, the approved programs consist of the AORs based on approved DDT proposals and the corresponding abstracts.

3.2 Reserved Observations Catalog

Each Call for Proposals (CP) is accompanied by a *Reserved Observations Catalog (ROC)*, a tabular list of targets and observing modes excerpted from the Science Operations Database. The ROC includes all AORs previously approved through all Spitzer observing programs. It also includes AORs resulting from time awarded through the Spitzer Fellowship Program, science quality In-Orbit Checkout/Science Verification observations and the instrument calibrations AORs.

During the time when a CP is active (i.e., between the release of the CP and the selection of observations for the pertinent observing cycle), no major changes are permitted in the ROC.

4 Modification of AORs

To accommodate the inevitable need of investigators to modify and refine their approved observations, procedures are established to allow for this process. The intent of these procedures is to allow adequate flexibility in modifying a Spitzer observing program to maximize the scientific value of an approved observation. The guiding principles underlying these procedures are:

- All programs executed by the Spitzer Space Telescope are properly reviewed and approved. The approval process described below is intended to ensure that the modified program, as executed, is approved and avoids duplicate observations.
- All modifications shall be such that the program stays within its originally allocated observing time.

The procedures described here exclude the procedures that will be followed in the catastrophic loss of a major instrumental or telescope function.

4.1 Types of Modifications

The Principal Investigator, according to the precepts and schedule outlined below, can modify an Astronomical Observation Request (AOR) in the Science Operations Database (SODB) electronically. Once an AOR has been scheduled for observation, typically five to eight weeks before execution, it cannot be modified without approval (which will be rare) of the SSC Director's office.

All requests for modification of approved AORs must be approved by the SSC Science User Support Team, which will characterize the request as one of two types. Minor modifications consist of small changes of target parameters, typically a few arcseconds in celestial coordinates, or small changes in AOR execution time (< 20%), subject to the total observing time in an investigation remaining constant. Minor modifications could also include small changes of other parameters in the AOR (e.g., change to high-dynamic mode in the IRAC AOR), as long as the changes do not alter the scientific content or intent of the original AOR.

Major modifications to an individual AOR consist of those changes that would substantially alter the scientific content or intent of the AOR. Examples of major modifications include:

- Changing the execution time of an AOR by 20 percent or more, thereby increasing the probability that duplicate observations might arise.
- Changing the sensitivity by a factor of 1.5 or more.
- Changing the target coordinates, or boundary area, by an astronomically significant amount.
- Changing the target to a different target judged by the investigator to be scientifically equivalent to the original target.

The execution of an approved observation may become infeasible (§11) or prove to be scientifically useless because of unanticipated circumstances. If these events occur, and if an observer can a priori demonstrate that the approved AOR will yield useless data, the Principal Investigator can submit a request to make major modifications to the AOR. The proposed modifications must be consistent with the original scientific intent of the approved observation and the observing time granted. In addition, it cannot duplicate any other approved observation, and must be approved by the SSC Director.

Requests for major modifications to any approved observing program or AOR must be made to the SSC Science User Support Team through the Helpdesk (help@spitzer.caltech.edu), and must be accompanied by adequate justification. Modifications are contingent upon approval by the SSC Director, or designee. Once the request for a modification is approved, the requestor may modify the AOR/program, with assistance provided by SSC Science User Support Team. The latter is responsible for insuring that the modifications are implemented as approved.

4.2 Blackout Period

There is a blackout period during which no *major* modifications to approved AORs or programs are normally allowed. The contents of the *Reserved Observations Catalog (ROC)* are frozen, and major modifications are not permitted while a solicitation for proposals for a new observing Cycle is active. This time period runs from the date the Call for Proposals is issued until the proposal submission date passes.

5 Targets of Opportunity

Targets of Opportunity (ToO) are transient phenomena whose timing and/or location on the sky are unpredictable. They include objects that can be generically identified before the onset of such phenomena (e.g., recurrent novae, variable stars) and predictable phenomena that can be expected, although whose precise timing cannot be specified *a priori* (e.g., newly discovered comets, novae, supernovae, gamma-ray bursts, extra-solar planets).

Predictable phenomena whose exact timing may remain uncertain at the time of proposal submission should be submitted in response to a General Observer Call for Proposals (CP). Observations of completely unanticipated phenomena can be requested through Director's Discretionary Time (DDT) procedures.

Starting with Cycle-6 only low-impact targets of opportunity may be included as part of GO proposals. High/medium impact ToOs must be requested via DDT proposals. At the time of proposal submission, investigators will classify each ToO request, based on the degree to which the execution of such an observation affects normal scheduling and observing procedures (see below).

A General Observer proposal must include a valid Astronomical Observation Request (AOR) for each predictable ToO observation, or representative AORs for proposals requesting > 50 hours. The AORs should be completed in as much detail as possible, lacking perhaps the precise target positions (i.e., a "null target") and refined integration times. The proposal must present a detailed plan of observations that will be implemented if the specific event occurs. Moreover, it

must also provide an estimate of the probability of occurrence of the specified event during the relevant Spitzer observing cycle(s).

The SSC Director reserves the right to designate any ToO data for early release when such a release is deemed (by the Director) to be in the interest of the community.

5.1 Classification of Impact

At the time of proposal/AOR submission, investigators must classify each ToO observation into one of three categories based upon the impact that the observation will have on the normal scheduling and observing procedures (if approved). The classification scheme is based solely on the time elapsed between the activation of a Target of Opportunity AOR (§5.2) and the execution of the corresponding observation:

High-Impact	< 1 week
Medium-Impact	1 – 8 weeks
Low-Impact	> 8 weeks

High/Medium impact ToO observations are not allowed in warm mission GO proposals. These observations must be submitted via a DDT proposal.

Starting with Cycle-7 the activation-to-execution window for a low-impact ToOs has been increased from 5 weeks to 8 weeks. There is no formal limit on the number of these low-impact ToO observations that can be approved.

Apart from the overhead burdens applied to all Spitzer observations (§1), the SSC will impose no additional overheads on low-impact ToO observations. The SSC has developed a separate calculation of the observatory overhead to be assessed against the high/medium-impact category of ToO observations. These special overhead burdens are described in Appendix E of the Call for Proposals. DDT proposals for high/medium impact ToOs must include the overhead in the total requested observation time.

An investigator will self-determine the appropriate category, based upon the maximum delay (in their judgment) that is scientifically acceptable between the activation of an approved AOR and the execution of the observation. This information will be useful in permitting the SSC and the reviewers to scientifically assess the value of the ToO observation vis-à-vis other approved observations.

5.2 Activation of AORs

For an approved ToO, the Principal Investigator (PI) must electronically submit a request for AOR activation to the SSC Director via the Spitzer Helpdesk (help@spitzer.caltech.edu). Following the request for activation, the SSC will ascertain the feasibility of conducting the ToO observations, taking into account sky visibility and the existing science schedule. The observer will also submit a revised AOR(s), with precise coordinates and integration time. If the observation(s) cannot be conducted on a schedule requested by the investigator, the SSC Director may consult with the Principal Investigator on the scientific utility of later observations. The

SSC Director must issue final approval for any high/medium-impact ToO observations requiring an interruption of the onboard observing schedule.

An approved ToO observation will be executed only in the event that the specified phenomenon actually occurs within the relevant observing cycle. If the triggering event for an approved ToO observation does not occur during the observing cycle, the AOR will be deactivated at the end of the cycle. Cycle-6 Exploration Science ToOs are valid for two years. In the event that a ToO observation expires without execution, the allotted observing time will be returned to the General Observer pool.

For a low-impact ToO, the fully specified AOR must be available for scheduling in the SSC operations database a minimum of eight weeks prior to its anticipated execution week.

5.3 Regulation of Observations

The SSC Director will rely on the recommendations of the reviewers to assess the benefits of a proposed ToO observation against any disruptions to the efficient planning and scheduling of science observations with the Spitzer Space Telescope. *The SSC will support a small number of high/medium impact ToOs on an annual basis (expected to be one or two per year) during the warm mission.*

6 Generic Targets

Generic targets denote observations that fail to qualify as Targets of Opportunity (i.e., they generally have more refined and predictive spatial and temporal information than ToOs), and can be scientifically described, but lack precise celestial coordinates or brightness estimates *at the time of Spitzer proposal submission*. A generic target can be selected from a complementary observing program with Spitzer, or with any other telescope, where the conditional observations (assumed to be under the control of or clearly available to the Spitzer Principal Investigator) are scheduled or will be scheduled with high likelihood, but not yet executed or analyzed prior to the Spitzer proposal deadline.

An investigator may propose observations of generic targets, describing them in as much detail as possible in a Spitzer observing proposal. In previous observing cycles, an AOR accompanying a generic target needed to contain a celestial position accurate to within 2 degrees (radial) for fixed targets. For Cycle-8 onwards, this requirement is removed. This will allow proposals for follow-up of well-defined scientific targets from, for example, the WISE mission. For a moving generic target (e.g., Solar System object) proposers must submit an AOR with a target position ‘to be determined’ from the Navigation and Ancillary Information Facility (NAIF) identification, or from orbital elements. In either case, the execution time must be specified to within a factor of 1.5.

After the complementary observations are obtained and analyzed, the Principal Investigator must modify the generic target AOR and include the precise celestial coordinates and integration time before the observations can be scheduled. The observations must be completed within the observing time allocation awarded when the proposal was approved. If your proposed targets are not known at the time of proposal submission you must provide a credible schedule for

determining the targets and delivering the AORs. Details will be worked with all successful teams. For generic targets the AOR must be fully specified at least 8 weeks prior to execution.

Proposals seeking to observe generic targets will be accepted for consideration through the normal processes if the following (relevant) conditions are satisfied:

- Rules pertaining to duplicate observations and priority of target selection (as specified in §2) apply. The basic principle is that the first observer who specifies the AOR with sufficient completeness to permit execution of the AOR has priority for the observation.
- The generic targets are selected from datasets to which the proposing investigator has clear access.

7 Commissioning of AOTs

During the cryogenic mission, commissioning of the multiple Astronomical Observation Templates (AOTs) was carried out during the first year of the mission. Each AOT was commissioned before it was used for routine science observations. The IRAC post-cryo Mapping AOT was commissioned prior to the start of nominal operations on July 28, 2009.

8 Routine Calibrations

The SSC establishes and maintains the calibration of the IRAC instrument (see the *Spitzer Observer's Manual – Warm Mission*). Routine calibrations are executed by the SSC on behalf of the community. Data resulting from routine facility calibrations generally enters the public domain immediately upon processing and validation by the SSC.

Observations of celestial targets necessary to establish and maintain the calibration of the AOT are not subject to rules regarding duplicate observations. The achieved calibration accuracy for AORs processed with the normal calibration pipelines is published as part of the *Spitzer Observer's Manual – Warm Mission*. For observations that require a higher level of calibration, and therefore special calibration observations (see §9), it is the responsibility of the requesting investigator to include those special calibration observations as part of their proposed observational program.

9 Special Calibrations

Any additional calibration(s) that are not included as part of routine calibrations (§8) conducted by the SSC will be regarded as special calibrations, and are the responsibility of the approved investigator. The observing time required to conduct such special calibrations will be charged against the observer's allocation and must be included in the original science proposal. The SSC will process such observations through the normal data processing pipeline(s). The investigator is responsible for using these data for the special calibration requirements of their program. The normal proprietary data period applies to special calibration data that are part of an approved science program.

All Spitzer Space Telescope data, including routine and special calibrations, may be accessed and analyzed by appropriate SSC instrument specialists to assess instrument performance and to

develop improved or necessary instrument calibrations. For such use of special calibration data, strict confidentiality will be maintained throughout the normal proprietary period.

Proposers are encouraged to consult with the Science User Support Team via the Helpdesk when planning to propose special calibrations.

10 Use of Parallel Observations

All of the science data obtained via a single Astronomical Observation Request (AOR) are considered to belong to the requestor of the observation, and are subject to the same proprietary data rights as the explicitly requested data. That is, the proprietary rules and periods apply to all of the data collected via a specific AOR, whether or not the observer explicitly requested them as part of their proposed science program.

11 Infeasible or Non-Schedulable Observations

All approved observations are accepted with the understanding that there can be no guarantee that the observations will actually be obtained. In specifying observations through the completion of Astronomical Observation Requests (AORs), the front-end graphical user interface to the Astronomical Observation Template (AOT) will not process invalid parameters. Therefore, a completed AOR represents a ‘doable’ observation, in principle. In practice, however, it could turn out that the actual execution of some observations could prove to be highly difficult or impossible. For example, on-orbit events may conspire to restrict the range of acceptable or safe AOT parameters, and thereby make previously approved observations infeasible. If the AOR can be modified to make the observation feasible, the Principal Investigator will be given the opportunity to make these modifications. Otherwise, the AOR will be abandoned without execution. The SSC Director will determine the usage of abandoned time from all investigations.

12 Failed Observations

A failed observation is one that cannot be calibrated, or where a significant fraction of the data is lost or severely corrupted, or where the data processing system (the “pipeline”) is incapable of processing the observation. Some failures may result from instrument anomalies, while other failures may be due to the loss of data in transmission.

If an investigator believes that an observation has failed or has been seriously corrupted or degraded, he/she can submit a written request to the SSC Science User Support Team via the Helpdesk (help@spitzer.caltech.edu) for a repeated observation. Any request for a repeated observation must be filed within **two months** of the investigator’s data being made available to the investigator. If the SSC concurs with the request, attempts will be made to repeat the observation. The SSC Director reserves the right, in cases where the request for a repeated observation is approved, to place the failed/degraded observations into the public archive immediately. The request for a repeated observation will not be granted when the PI has committed an error in specifying the AOR.

If an investigator has obtained more than 90% of the data in a planned and approved observing program, and the missing data are not uniquely important for the scientific goals of the program, then the request for a repeated observation will not normally be granted.

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13 Data Rights

Observers may have exclusive access to their science data during a proprietary period, intended to facilitate the processing and scientific analysis of the data by the relevant investigator. For regular General Observer and Snapshot programs, Spitzer observations shall have a proprietary data period of twelve months, commencing from the time that scientifically usable data from fully commissioned pipelines are made available to the Principal Investigator via the Spitzer Science Archive. For Exploration Science General Observer programs, Spitzer observations have a maximum proprietary period of three months. Once the proprietary period expires, the raw and pipeline-processed data will enter the public domain and be available to anyone through the Spitzer Science Archive. **The SSC no longer does duplication checks or embargoing data from duplicating observations in the warm mission. Therefore the SSC may not be able to ensure all proprietary periods for warm mission observations.** Only a small number of observations are likely to be affected.

The SSC Director reserves the right to designate any Target of Opportunity data for early release when such a release is deemed to be in the interest of the community.

Because observations obtained through Director's Discretionary Time (DDT) are assumed to be urgent and of interest to the broad scientific community, proprietary periods for DDT observations will not exceed three months. The SSC Director reserves the right to make all raw and calibrated data publicly available immediately as a condition for approving a DDT request, particularly when the data involve an unexpected Target of Opportunity.

The Spitzer Time Allocation Committee may recommend a shorter proprietary period for individual proposals, particularly large programs, due to the high value of the data to the general astronomical community. As part of their proposal, observers may request that the SSC Director waive all or part of their proprietary period if the proposal is approved.

14 Publication and Dissemination of Science Results

It is expected that scientific results obtained through Spitzer Space Telescope observations, archival research, and theoretical investigations will be published in the scientific literature. All publications based on Spitzer data must carry an appropriate acknowledgement. Investigators should consult the SSC website for the appropriate acknowledgement template(s) (<http://ssc.spitzer.caltech.edu/spitzermission/publications/ackn/>).

In papers describing Spitzer results, investigators should provide reference(s) to seminal papers describing the Observatory, including the relevant science instruments. These references are posted on the SSC website at (<http://ssc.spitzer.caltech.edu/spitzermission/publications/>).

Moreover, the SSC encourages investigators to provide reference(s) to seminal Legacy Science project results, where appropriate

[\(http://ssc.spitzer.caltech.edu/spitzermission/observingprograms/legacy/\)](http://ssc.spitzer.caltech.edu/spitzermission/observingprograms/legacy/).

The publication and dissemination of Spitzer science results is critical in assessing the success of the mission, and its contributions to NASA's strategic plans in space science. The Spitzer community is reminded of the important responsibility inherent in utilizing this national resource, and in sharing the scientific results with the general public. The SSC Director encourages investigators with newsworthy results to utilize the resources and services of the SSC, JPL and NASA to help disseminate important results to the mass media and to the general public.

Appendix: Acronyms and Abbreviations

AOR	Astronomical Observation Request(s)
AOT	Astronomical Observation Template(s)
CP	Call for Proposals
DDT	Director's Discretionary Time
GO	General Observer(s)
GTO	Guaranteed Time Observer(s)
IRAC	InfraRed Array Camera
JPL	Jet Propulsion Laboratory
NASA	National Aeronautics and Space Administration
PI	Principal Investigator
ROC	Reserved Observations Catalog
SODB	Science Operations Database
SSC	Spitzer Science Center
TAC	Time Allocation Committee
ToO	Target(s) of Opportunity