Design Reference Mission Overview

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The Design Reference Mission

- **What the DRM is:**
  - **A required product at major mission reviews**
  - **An existence proof that mission objectives can be met in required lifetime**
  - **A tool for exercising the ground system & flight software**
    - Does proposal system support all the observing modes?
    - Can planning/scheduling tools build the timeline & command loads?
    - Will command loads execute on the spacecraft & instrument simulators?
    - Does observing efficiency in simulator match expectations?
    - Does telemetry support data processing of all observing modes?
    - Are pipeline products properly ingested into the archive?

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- **What the DRM is not:**
  - **The actual observing plan**

Representative Surveys
(from the design reference mission)

- **Cumulative point-source depth in wide-area surveys:**
- **High Latitude Survey** — **Wide 2000 deg^2** — **Deep 20 deg^2**
  - Imagining in 4 filters (5σ) — AB ~26.5 — AB ~28.2
  - Grism (6.5σ line flux 1.8μ 0.2"r_{eff}) — $8 \cdot 10^{-17}$ — $3 \cdot 10^{-17}$
- **SN Ia Survey (5-day cadence)** — **Wide** — **Deep**
  - Imaging in 4 filters (5σ) — AB ~28.6 16 deg^2 — AB ~29.5 5.3 deg^2
  - Prism (10 σ continuum) — AB ~25.3 3.3 deg^2 — AB ~26.1 1.1 deg^2
  - There are many possible SN survey implementations!

- **Microlensing:**
  - Monitor 2+ deg^2, 15 minute cadence over 72-days, S/N=100 @ AB=21.4 per visit
  - Exoplanet detections by microlensing, other time-domain astronomy,
  - Precision astrometry (tens of micro-arcsec)

Scheduling considerations - 1

- **High Latitude Survey**
  - No cadence requirements per se
  - Spectroscopic survey will want observations of any given field at roughly opposite dispersion directions
    - Have only one grism, so schedule revisits separated by ~6 months
  - Want survey regions to be contiguous, or at minimum not split into many sections
    - Could imagine a region in South and another in North perhaps
- **Supernova Survey**
  - Want continuous coverage of a particular field for ~ 2 years
  - Visits at 5-day cadence
- **Microlensing Survey**
  - Want continuous coverage of a particular field for entire visibility period
    - 60-72 days, Spring and Fall
  - Visits at 15-minute cadence
  - Longest possible total time baseline
    - accurate proper motions and maximizing separation of stars in lensing events

Scheduling Considerations - 2

- **Likely layout over 5-year mission**
  - Microlensing seasons Spring and Fall of first year and last year, 2 more somewhere in between
  - Supernova campaign somewhere in years 2-4 to avoid conflicting with microlensing campaigns
  - High Latitude Survey can be distributed throughout
  - GO observations can be distributed throughout

Notional Observing Program Overview
(from Mission PDR)

OBSERVING PROGRAM LAYOUT

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
MISSION YEAR 1 (2026)	HLS GO	EMS	EMS	HLS GO	EC HLS	GO PA/C	HLS EC	EMS	EMS	HLS EC	GO EC	HLS GO PA/C
MISSION YEAR 2 (2027)	EC GO	EMS	EMS	HLS EC	HLS GO PA/C	SNS HLS	SNS GO	SNS HLS	SNS GO	SNS GO	SNS HLS	SNS HLS PA/C
MISSION YEAR 3 (2028)	SNS HLS	SNS GO	SNS HLS	SNS GO HLS	SNS GO PA/C HLS	SNS HLS	SNS HLS	SNS GO	SNS HLS	SNS GO HLS	SNS GO HLS	SNS GO PA/C
MISSION YEAR 4 (2029)	SNS HLS	SNS HLS	SNS GO	SNS GO HLS	SNS HLS GO	HLS PA/C	GO HLS	EMS	EMS	HLS	GO HLS	HLS PA/C
MISSION YEAR 5 (2030)	HLS GO	EMS	EMS	HLS GO	HLS GO	GO PA/C	HLS	EMS	EMS	GO HLS	HLS	GO PA/C

LEGEND

HLS	High Latitude Survey (Imaging & Spectroscopy)
SNS	Supernova Survey (Imaging & Spectroscopy)
EMS	Exoplanet Microlensing Survey
GO	General Observer Program
EC	Exoplanet Coronagraphy Program
PA/C	Payload Alignment/Calibration

- Notional Observing Program activities are represented in each month as **a *percentage of time dedicated to that activity***
- Durations range from 1 week (25%) to 4 weeks (100%)
- Routine mission overheads (e.g. large slews between observing programs, momentum unloads, station-keeping) are interleaved with the observing program activities

1-month
25%
25%
25%
25%

Notional layout demonstrates capability to meet science objectives within scheduling constraints

Summary

- The layout shown on the previous slide shows the qualitative features of a sample schedule.
- In real life programs will be distributed in a more fine-grained fashion.
- Present best estimates of observing efficiency and overheads show that all programs can meet their requirements in a 5-year mission with 86 days margin.

- Will the actual observing program look like the present DRM?
  - No. But at least some parts are likely to be similar.