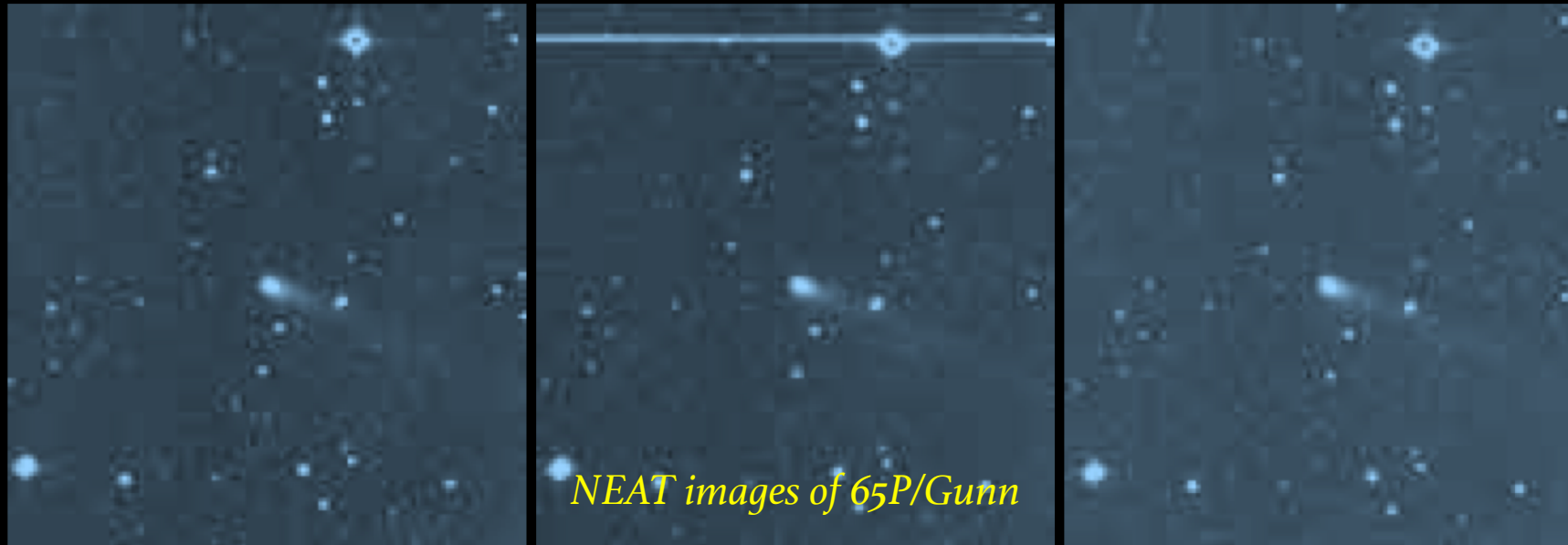
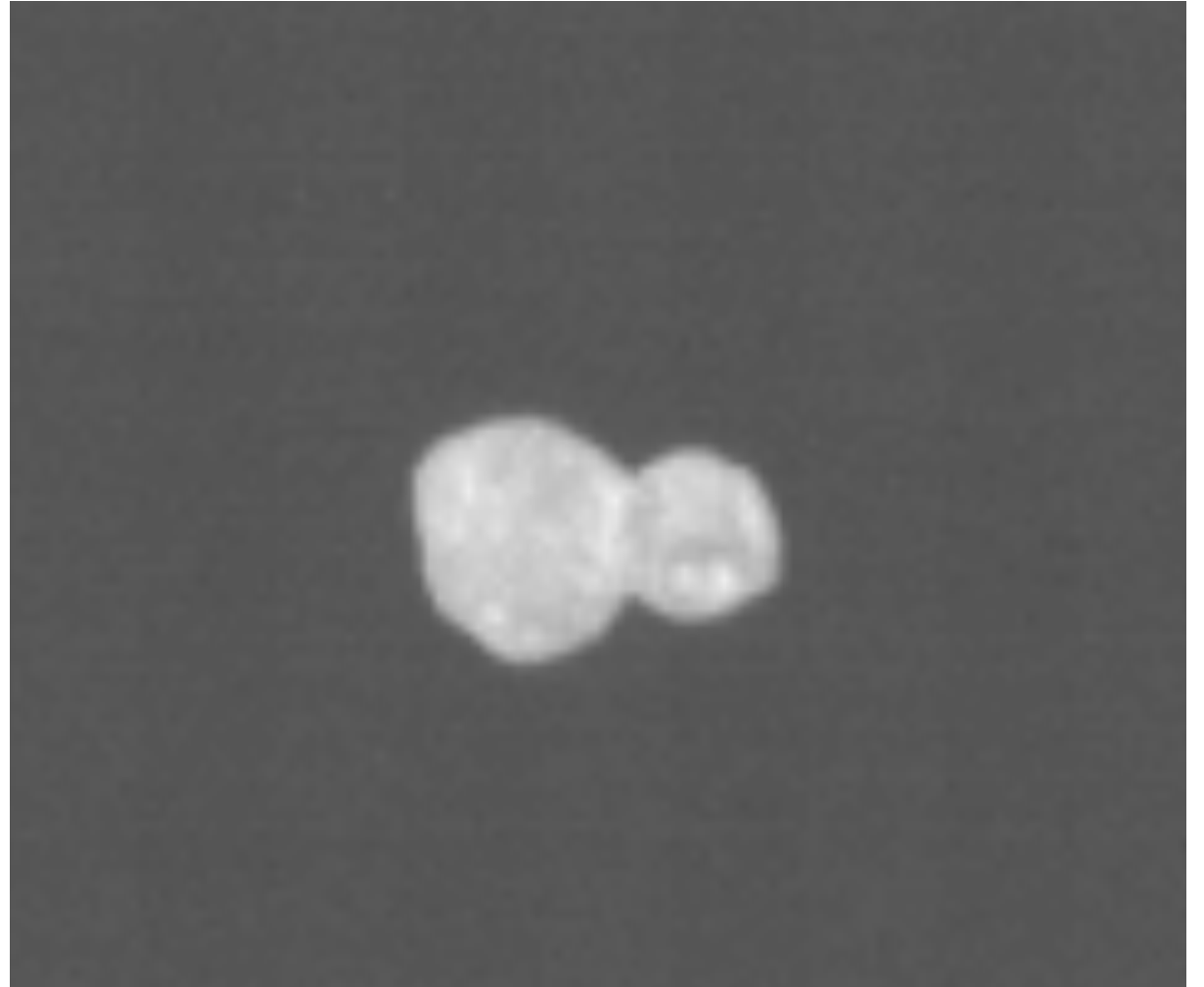
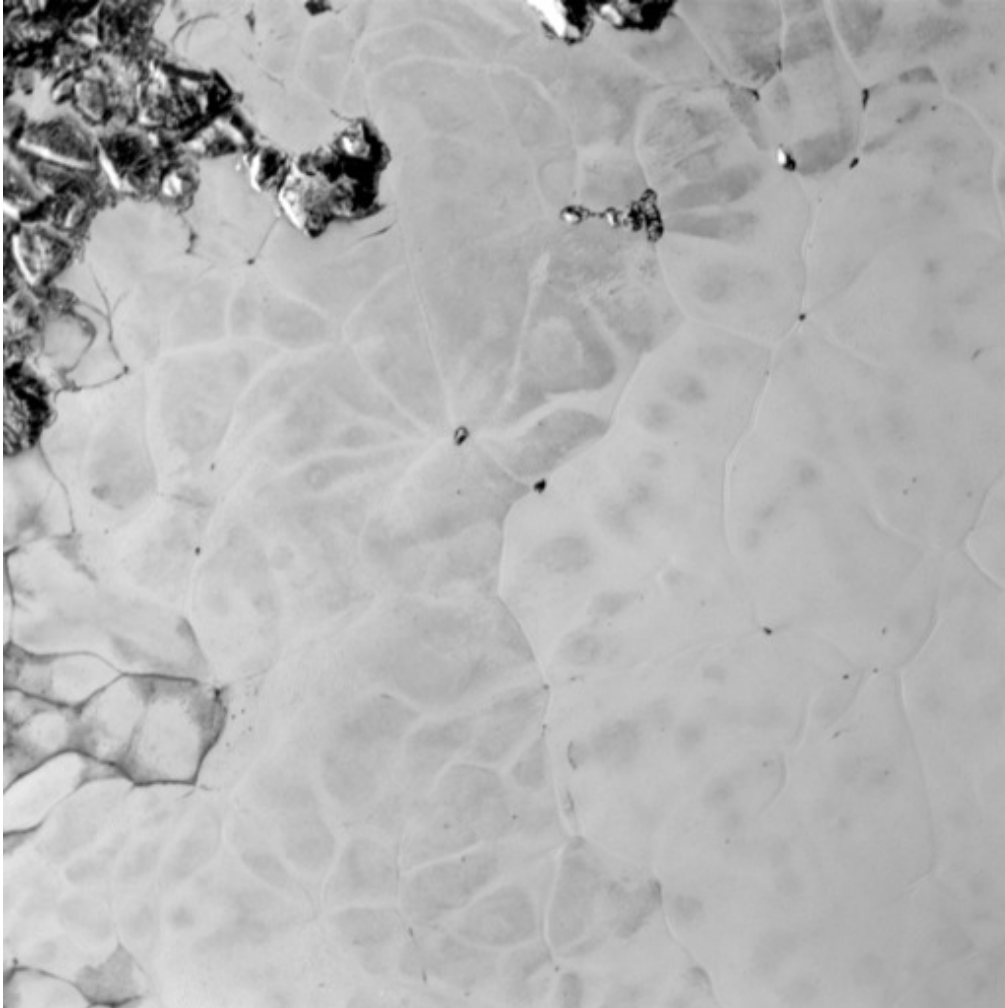


The NASA Planetary Data System's Small Bodies Node, the MPC, and Planetary Defense



G. (J.) Bauer, M. Payne, M. Holman, E. Palmer, C. Neese, L. Kolokolova, A. Raugh, A. Mamoutkine, P. Lawton, Q. Ye, and the SBN and MPC teams

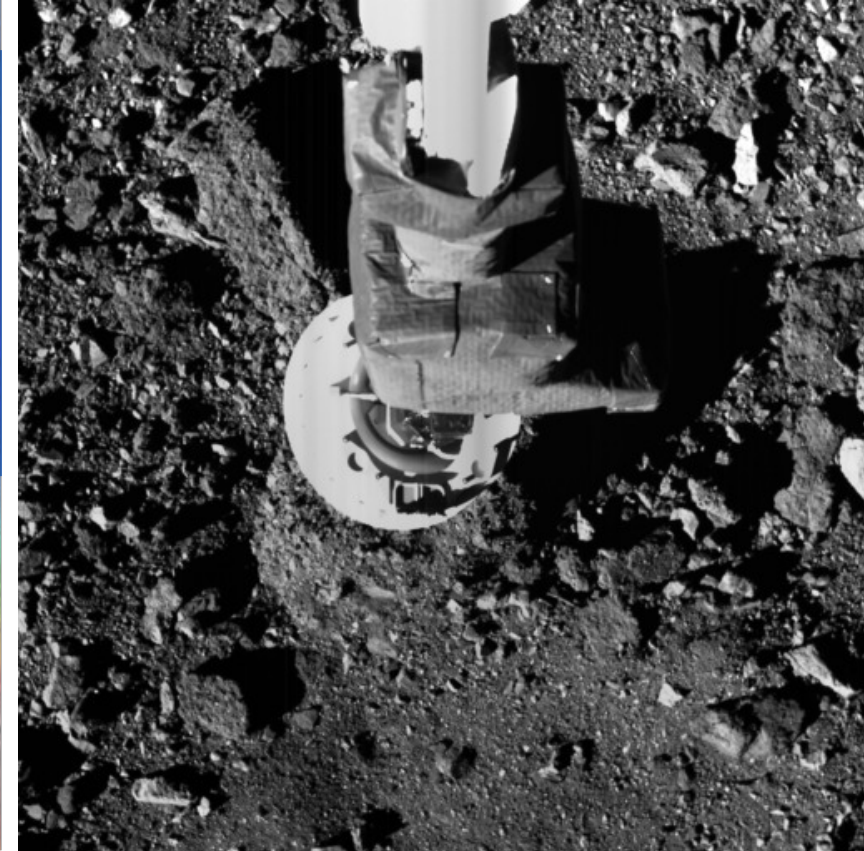
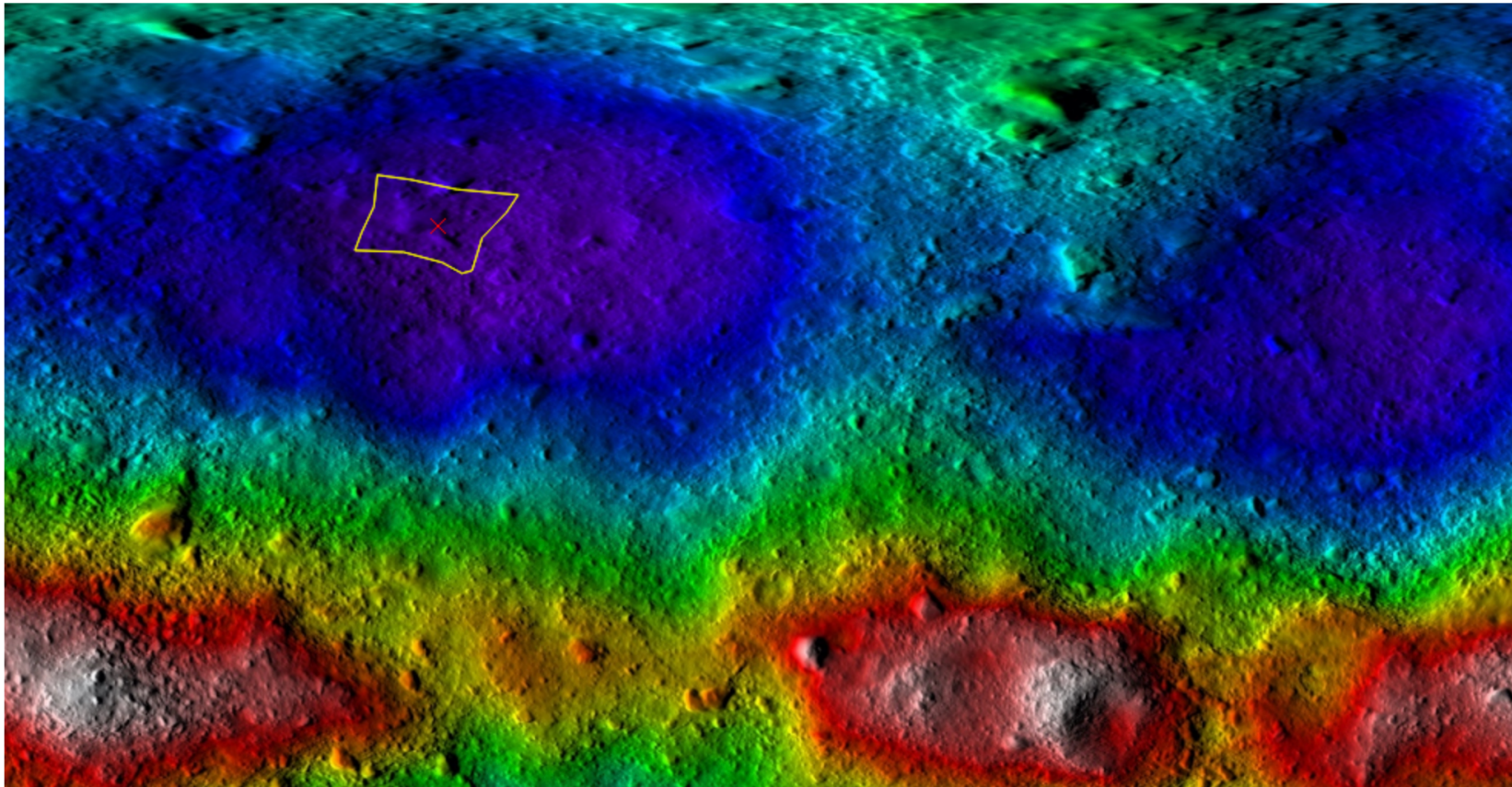
Mission Archive Status Highlights



- **NH/NH-KEM:** NH Pluto flyby P4 data were lien resolved in August 2020. Final release and archiving on 2020-08-21. Arrokoth approach K2 data released and archived on 2020-08-31. Arrokoth approach K3 data reviewed December 4, 2020 *in lein correction*. Initiating migration to PDS4.

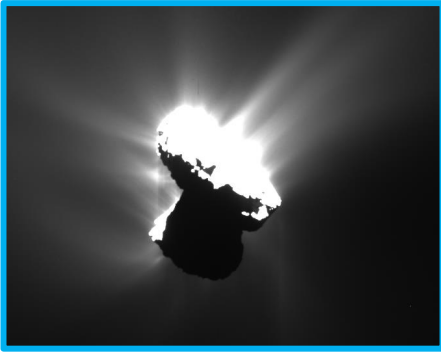
Mission Archive Status Highlights

- **OSIRIS-REx:** All instruments delivering quarterly on schedule, except OLA which has suspended deliveries to update its pipeline for calibration. (Note that the bulk of OLA observations have already been archived.)



- *May 2020, OSIRIS-REx Bennu release #6 including OCAMS, OTES, OVIRS, TAGCAMS, RS, and Mission bundle.*
- *Nov. 2020, OSIRIS-REx Bennu release #7 including OCAMS, OTES, OVIRS, TAGCAMS, RS, and Mission bundle.*
- *SBIB now contains all archived OSIRIS-REx OCAMS data through sample collection.*

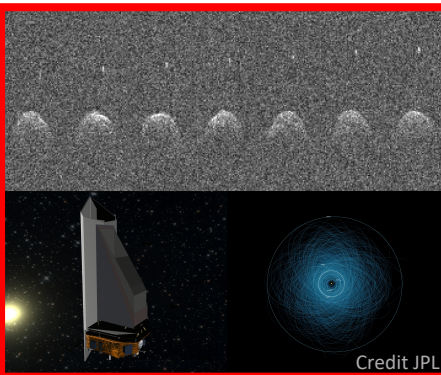
Mission Archive Status Highlights



- **Rosetta (67P):** Delivered >950 datasets (>25 TB). Awaiting some final product deliveries from OSIRIS and RPC instruments. Instrument Data Dictionaries - 90% are drafted or complete, and migration to PDS4 is beginning.



- **Hayabusa 2 (Ryugu):** The Hayabusa2 reviews are going very well. Thanks to the excellent work of the Hayabusa2 instrument teams and archive team. **Two reviews have been completed and three in progress.**



- **Future Missions:** DART DMAP finalized, LUCY ICD document finalize and DMAP due 2021, PSYCHE SDMP finalized and working on SIS. **NEO Surveyor diameters** will also be delivered to the SBN (along with the rest of the **NEOWISE diameters**). ALSO radar data.

Migrations, Software & Standards

- Many datasets are in PDS3, PDS/SBN are migrating older datasets to PDS4:
 - Allows fuller metadata for search, discoverability and description of data.
 - Creates a uniform structure and design of uniform interfaces.
 - Rosetta and NH are datasets that are PDS3 that are high-priority for migration, but older datasets (DI/EPOXI, Stardust, etc.) are being migrated as well.
- Update to Radio Science: There is now an ICD for DSN trk-2-34 files.
- New variations of line ending markers in digital files - support Unix-based (LF).
- PDS4 Reader/Viewer update (SBN maintained)

Data Archive Totals:

Total of 104 TB and growing quickly...

- *Comets/Icy Bodies: 78 TB*
- *Asteroids/Dust: 26 TB*

SBN Archive Surveys:

Pre-discovery and characterization resource base

Survey	Status	Comments
NEAT	Archived (10 TB)	Migrated to PDS4, QUEST data in process
Spacewatch	Reviewed	Peer review of a 1-lunation sample of the 0.9m mosaic camera data set was completed, and the data set is now in liens resolution
CSS	Lien Correction	Delivery and ingestion pipelines are now in place.
ATLAS	109 nights /30 TB delivered	Meta-data templating, ongoing deliveries at ~ 1 data month/week

Ancillary to MPC activity - Sky Surveys

- *Spacewatch* lien correction, *ATLAS* deliveries underway, *CSS* sample under review.
- Estimating data-volumes approaching Pbytes in 2022.
- **Significant Hurdle** – Data Access is being addressed ...
 - beta release of the CATCH service <https://catch.astro.umd.edu/>
 - Utilizes MPC data, but working to reference live id-resolution through MPC APIs
 - Also hoping to incorporate MPChecker for identification of objects within individual survey frames.

CATCH Service Summary

CATCH

About

APIs

Contact



- <https://catch.astro.umd.edu/>
 - α -release (Users Group) -10/30, 2019, Re-release (β) Oct. 2020
 - Authors (SBN): M. S. P. Kelley, D. Darg
 - Search tool for individual objects
 - Effective name resolution
 - API based - automation and integration with other search tools
-
- Future Augmentations
 - Sky-position search
 - More surveys (ATLAS, CSS)
 - Possible cloud implementation

COMET ASTEROID TELESCOPIC CATALOG HUB

SBN IAWN support

- [IAWN](#) pages and support
 - Coordinating Campaigns (Apothis 2021)
 - V. Reddy coordinator through SBN/UMD sub-award.
 - Tech. support through SBN (Farnham, Kelley (UMD), and Warner).
 - HQ Support: Mike Kelley (NASA HQ)
 - Posting articles, notices, membership and meeting material
 - Close Approach tables
 - IAWN site managed by T. Spahr (NEO Sciences).
 - Utilizes multiple resources (MPC, CNEOS, SMPAG, UNCOPUOS)

International Asteroid Warning Network

- Home
- ABOUT
- FEATURES
- NEO News
- MEETINGS
- CLOSE APPROACHES
- CAMPAIGNS
- SUPPORT DOCUMENTS
- GALLERY
- FAQs
- Links
- Contacts

Our Mission

IAWN was established (2013) as a result of the UN-endorsed recommendations for an international response to a potential NEO impact threat, to create an international group of organizations involved in detecting, tracking, and characterizing NEOs. The IAWN is tasked with developing a strategy using well-defined communication plans and protocols to assist Governments in the analysis of asteroid impact consequences and in the planning of mitigation responses.

Currently, IAWN includes members from Europe, Asia, South and North America.

[About IAWN](#)

Observers Twitter feed

Tweets from some of our observing signatories and other active asteroid observers.

IAWN-asteroids

A Twitter list by @SBNarchive

Catalina Sky Survey

@catalina_sky

Nice article about our record year!

[tucon.com/news/local/un...](#)



University of Arizona asteroid hunter...

Twenty years ago, there were fewer tha

Embed View on Twitter

Signatories Twitter feed

Tweets from some of our institutional signatories (may have non-asteroid news as well).

IAWN-signatories

A Twitter list by @SBNarchive

ZTF Survey

@ztfsurvey

Fantastic science as a result of a global multi-messenger followup effort of a TDE AT2019DSG discovered by @ztfsurvey

[https://twitter.com/deeynews/status/1363881238285574144](#)

20m

ESO

@ESO

#ESOjobs We are looking for two Astronomers in San Pedro de Atacama, Chile, at the

Embed View on Twitter

NEO News

Upcoming NASA Telescope time

- Keck deadline for 2021B (August 1, 2021 - January 31, 2022); the Call for Proposals for 2021B will be available in February with a due date of March 18, 2021.
- IRTF deadline for 2021B (August 1, 2021 to January 31, 2022) is Thursday, April 1, 2021, 5PM Hawaii Standard time.

Community Announcement

Planetary Defense Conference 2021

The 7th IAA Planetary Defense Conference in 2021 is being hosted by the UN Office for Outer Space Affairs (UNOOSA), and will take place April 26-30, 2021.

NOTE: Abstracts due January 31st!!

[Read More: Conference Webpage](#)

NEO News

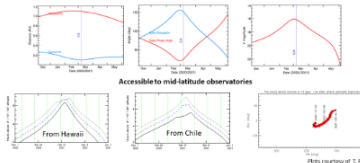
Apothis Observing Campaign 2021

(09 Oct 2020) The campaign will be modeled on our experience from the two previous campaigns to find out if we can conduct a successful, coordinated observing campaign with relatively short lead time to assess the hazard potential of a large NEA.

Apothis 2021: IAWN Planetary Defense Campaign

- Has a close flyby of the Earth in March 06 2021 (CA dist ~0.11 AU).
- Makes for an iconic target for global planetary defense exercise.
- More details: [http://iawn.net/obscomp/apothis/](#)

Campaign Coordinator: Videnu Reddy



Accessible to mid-latitude observatories

From Hawaii From Chile

Photo courtesy of T. Farnham

[Read More: Apothis Campaign](#)

Close Approaches

Asteroid designation: 2021 DN1
Discovery station: Palomar Mountain-ZTF
Close approach date (UTC): 2021 02 18 14
Close approach distance (x lunar distance): 0.88
[Discovery announcement](#)
[Latest orbit & observations](#)

[Close Approach List](#)

[Multi-Opp. CAs](#)

Latest from IAWN

Welcoming 5 new IAWN members!

(Dec 2020) The IAWN Steering Committee has approved several more members since the summer. They are:

- Borisov's Discovery Telescope Courtesy: G. Borisov
- Keldysh Institute of Applied Mathematics of the Russian Academy of Sciences (KIAM RAS)
- Agenzia Spaziale Italiana (ASI)
- Baldone Astrophysical Observatory, Latvia
- Osservatorio Astronomico "G.V. SCHIAPARELLI", Italy
- Observatoire de la Côte d'Azur (OCA)

[Read More: Welcome New Members](#)

Copyright © 2020. All Rights Reserved.
Web Accessibility
Web Template created with Aristeer.

Contact | FAQs | Links | Credits | Sitemap | Search
PDS-SBN | MPC | PDCO | SMPAG

Updated: 04-Feb-2021

IAWN Mgr: Dr. Tim Spahr
SBN PI: Dr. Geris Bauer
Web: Elizabeth Warner

99942 Apophis 2021 -- Gallery

Campaign Home page

Current Status
Physical Properties
Observations
Orbit
Observing Geometry
Gallery

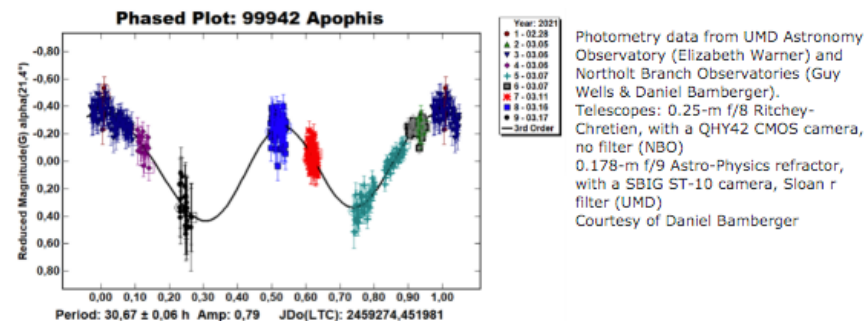
RELATED LINKS

International Asteroid Warning Network
Planetary Defense Coordination Office
NASA PDS: Small Bodies Node
Minor Planet Center (MPC)
Center for Near Earth Object Studies

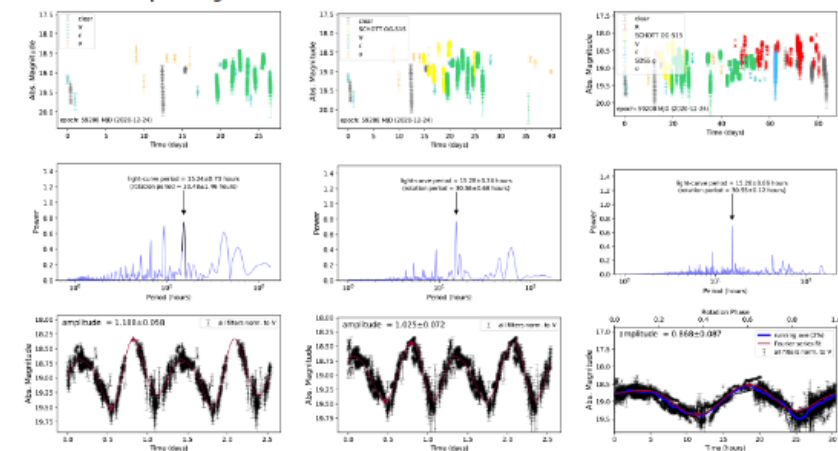
OBSERVING CAMPAIGNS

The Comet Wirtanen Campaign
4*P Coma Morphology Campaign
Comets & Asteroids Collaborative Astronomy Observers

IMAGES



Evolution of the periodogram



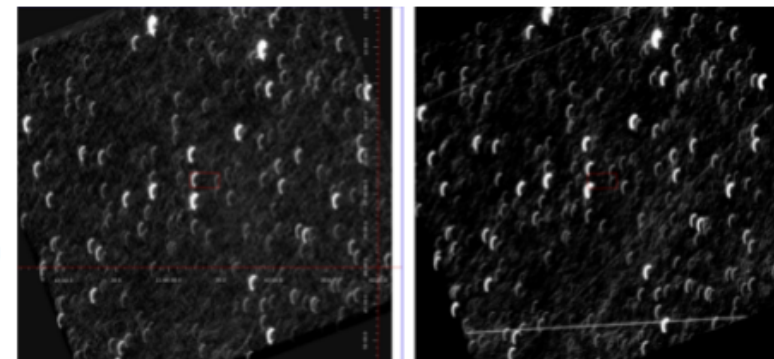
21 Jan (left), 4 Feb (middle), 18 Mar (right)

Nic Erasmus, photometry lead for the Apophis 2021 Observing Campaign, has been collating photometric measurements from many observers participating in the exercise to observe Apophis as if it were a new object. To date, the observations show a full rotation-phase coverage and with the strongest periodogram peak at the known period. Data continues to be collected.

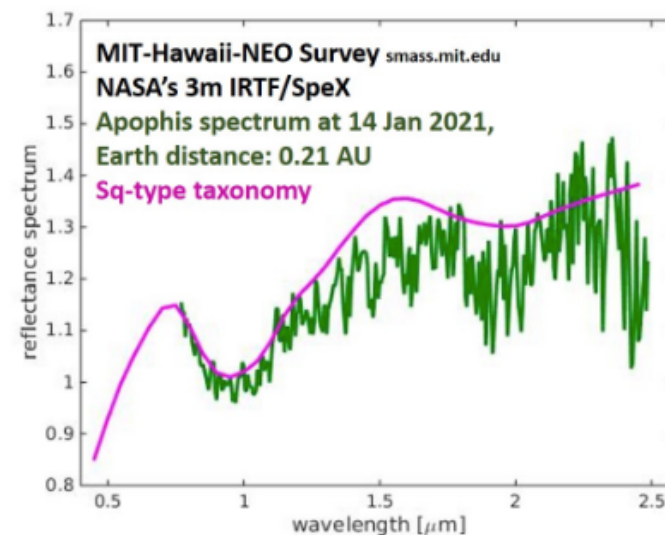
1. ATLAS's HKO and MLO (c- and o-filter data, 120 data points, the ATLAS team)
2. Calar Alto Observatory's Schmidt (V-filter data, 3323 data points, E. Petrescu and M. Micheli)
3. Cerro Tololo's Prompt5 (R-filter data, 5 data points, S. Zola)
4. Meckering Observatory's Prompt-MO1 (R-filter data, 10 data points, S. Zola)
5. Winer Observatory's 0.7-m (R-filter data, 168 data points, K. Kaminsky and M. K. Kaminska)
6. Suhora Observatory's 0.6-m (R-filter data, 45 data points, M. Drozd, W. Ogloza and M. Zejmo)
7. Wise Observatory's 28-inch (clear filter data, 95 data points, D. Polishook)
8. Kitt Peak's 1.8-m (SCHOTT OG-515 filter data, 598 data points, M. Brucker and J. Larsen)
9. SAAO's Lesedi (V-filter data, 652 data points, N. Erasmus, R. Lees and P. Janse van Rensburg)
10. Kourouva Astronomical Observatory's 0.4-m SBB telescope (R-filter data, 322 data points, D. Glamazda, G. Kaiser, E. Kuznetsov and A. Perminov)
11. UMD Astronomy Observatory's 7-inch (R-filter data, 405 data points, E. Warner)
12. Northolt Branch Observatory's 0.25-m (clear filter data, 366 data points, G. Wells and D. Bamberger)

Courtesy of Nic Erasmus and the above listed observers!

Potential Earth-impactor (99942) Apophis on UT 2021 Jan. 16 (18:21 and 21:45). Exposure duration is 2520 and 2640 seconds. The FOV is 51x51 minutes of arc, orientation north-up/east-left. At the time of observation the object was 111.0 degrees from the sun and 0.204 AU from the Earth. The parallax effects of the spacecraft during nearly half an orbit (101 minute orbit) are seen in the star arcs. The radial profile of the object shows no sign of cometary activity. Canadian NEOSat orbiting telescope (C53).
Courtesy of D. D. Balam (DAO), C. E. Spratt (ret), D. W. E. Green (CBAT), J. Psotka (CSA) & Canadian Space Agency.



Spectra



Reflectance spectrum of Apophis, observed with NASA's IRTF, matching a Sq-type.
Courtesy of David Polishook



Asteroid APOPHIS March 07 / 2021 (U.T)

By: Alberto Quijano Vodniza
University of Narino Observatory
Pasto, Narino. COLOMBIA

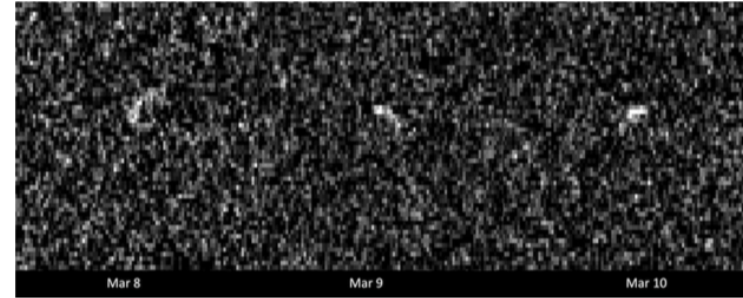
Video : 34 pictures
First picture : 00h: 31': 23''
Last picture : 00h: 59': 10''
Interval of time = 27 minutes + 47 seconds

Coordinates of Asteroid (average):
R.A = 09h: 22': 24''
DEC = - 06°: 50': 02''

CGE Pro 1400 CELESTRON telescope &
STL - 1001 E SBIG camera
Image scale = 2.53 arcseconds/pixel
Binning 2X2



International Asteroid Warning Network (IAWN) Apophis Campaign



Credits: NASA/JPL-Caltech and NSF/AUI/GBO

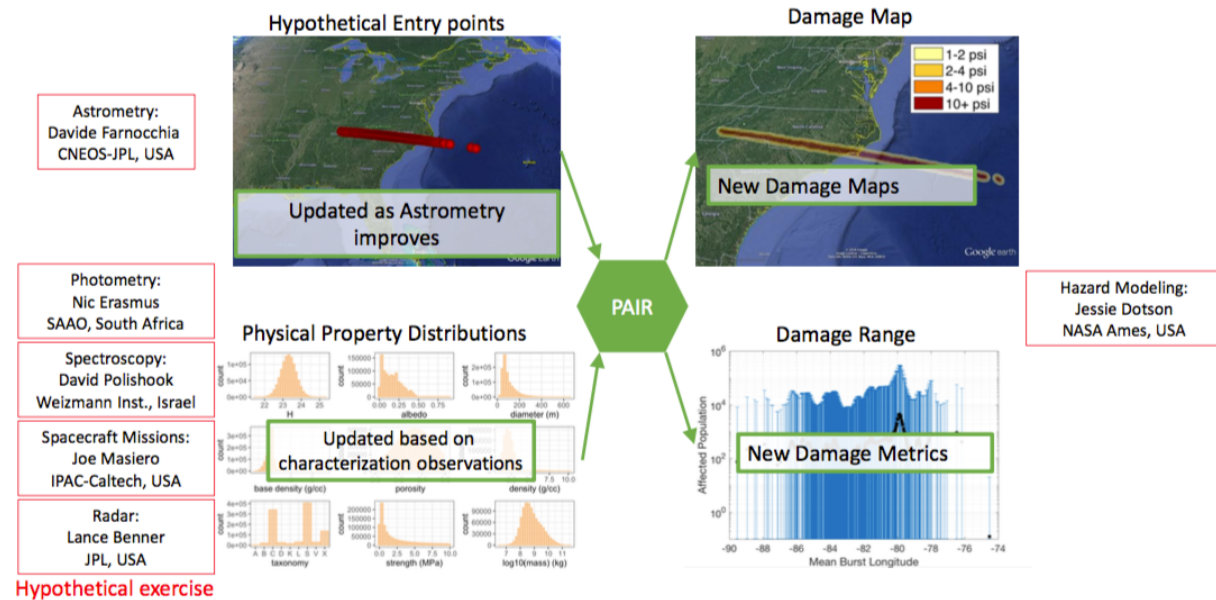
NASA PDCO Lead: Mike Kelley, NASA HQ

IAWN Coordinator: Prof. Vishnu Reddy (University of Arizona)

Group Leads: Davide Farnocchia (JPL), Jessie Dotson (NASA ARC),
Nicolas Erasmus (SAAO), David Polishook (WIS), Lance Benner (JPL),
Joe Masiero (IPAC, CalTech), James (Gerbs) Bauer (UMD)

Hypothetical exercise

Probabilistic Asteroid Impact Risk (PAIR) in Apophis Exercise



Hypothetical exercise



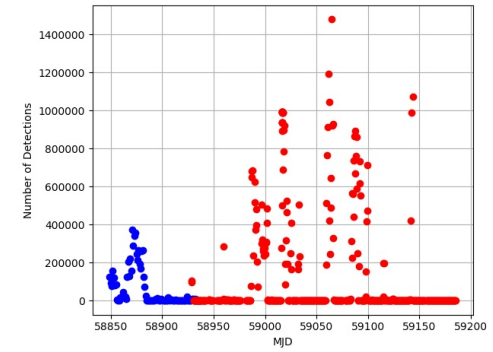
Minor Planet Center / SBN Archive joint activities



- Technical schema drafted for issuances of DOIs for MPECs and Monthly products
- Sungrazing comet data processing re-started in August
- **Small Bodies Name Resolution service with MPC** : MPC standing up APIs for cross-ID resolution using ID tables from new pipeline database.

Minor Planet Center / SBN Archive

joint activities



DB Status Monitoring & Distribution:

- Maintain MPC database Backups and distribute Postgres DB.
- Additional Products based on DB (status, recent observations, etc.)
- Participate in JIRA helpdesk for DB distribution management and troubleshooting.
- **Fail-over testing initiated:**
 - Identified a preferred methodology
 - Presently internal testing on a two-node cluster, next...
 - Test for scale.
 - Migrate to PSI sub-node as hot standby fail-over server.

MPC IAWN SBN

SBN-MPC DB Reports MUG

MariaDB mpc_development:

Source file of data: [statusDB.csv](#)

Table	Count	Created_at	Updated_at
close_approaches	223366	2019-05-23 19:22:13	2019-05-23 19:22:13
comet_names	4586	2017-03-15 16:46:33	2017-03-15 16:46:33
comet_orbit_uncertainties	1015	2019-06-04 12:15:27	2019-06-04 12:15:27
comet_orbits	10696	2021-01-23 01:38:44	2021-01-23 02:31:03
identifications	561115	2021-01-25 12:05:23	2021-01-25 12:05:23
isolated_tracklets	29974761	2021-01-25 17:05:40	2021-01-25 17:05:40
mpc_indices	67	2021-01-25 17:00:01	2021-01-25 17:00:01
numbered_identifications	899468	2020-12-17 18:00:55	2020-12-17 18:00:55
numbered_mps	546846	2011-10-27 14:22:17	2020-12-17 18:10:31
obs_request_observers	52	2019-07-24 16:57:48	2019-07-24 16:57:48
obs_request_users	7	2015-12-04 00:25:22	2015-12-04 00:25:22
observations	282678364	2021-01-25 17:10:01	2021-01-25 17:10:01
orbit_uncertainties	787375	2019-06-03 12:14:48	2020-10-19 14:32:50
orbits	1045235	2020-11-16 12:08:21	2021-01-25 12:31:47
perturbed_orbits	175741560	2018-09-27 13:20:33	2018-09-27 13:20:33
radar_observations	1507	2019-05-30 03:12:41	2019-05-30 03:12:41

No change in Maria mpc_development database structure.

Postgres mpcbeta:

Table	Count	Created_at	Updated_at
neocp_els	30	2021-01-13 09:00:18.185299	2021-01-25 16:30:32.641859
neocp_events	76549	2021-01-25 17:05:41.410812	2021-01-25 17:05:41.410812
neocp_obs_archive	220520	2021-01-25 15:01:41.380804	2021-01-25 15:01:41.380804
neocp_obs	319	2021-01-25 15:01:41.37533	2021-01-25 15:01:41.37533
neocp_prev_des	39796	2021-01-25 17:05:41.379551	2021-01-25 17:05:41.379551
neocp_var	81065	2021-01-25 16:30:40.933953	2021-01-25 16:30:40.933953
current_identifications	1588776	2021-01-25 15:51:59.871689	2021-01-25 15:52:14.81544
numbered_identifications	547402	2020-10-13 19:34:34.129247	2020-10-13 19:34:34.129247
primary_objects	1140798	2021-01-25 15:51:59.861306	2021-01-25 15:51:59.861306

No change to Postgres mpcbeta database structure

YYYY-MM-DD - latest record is older than 3 days

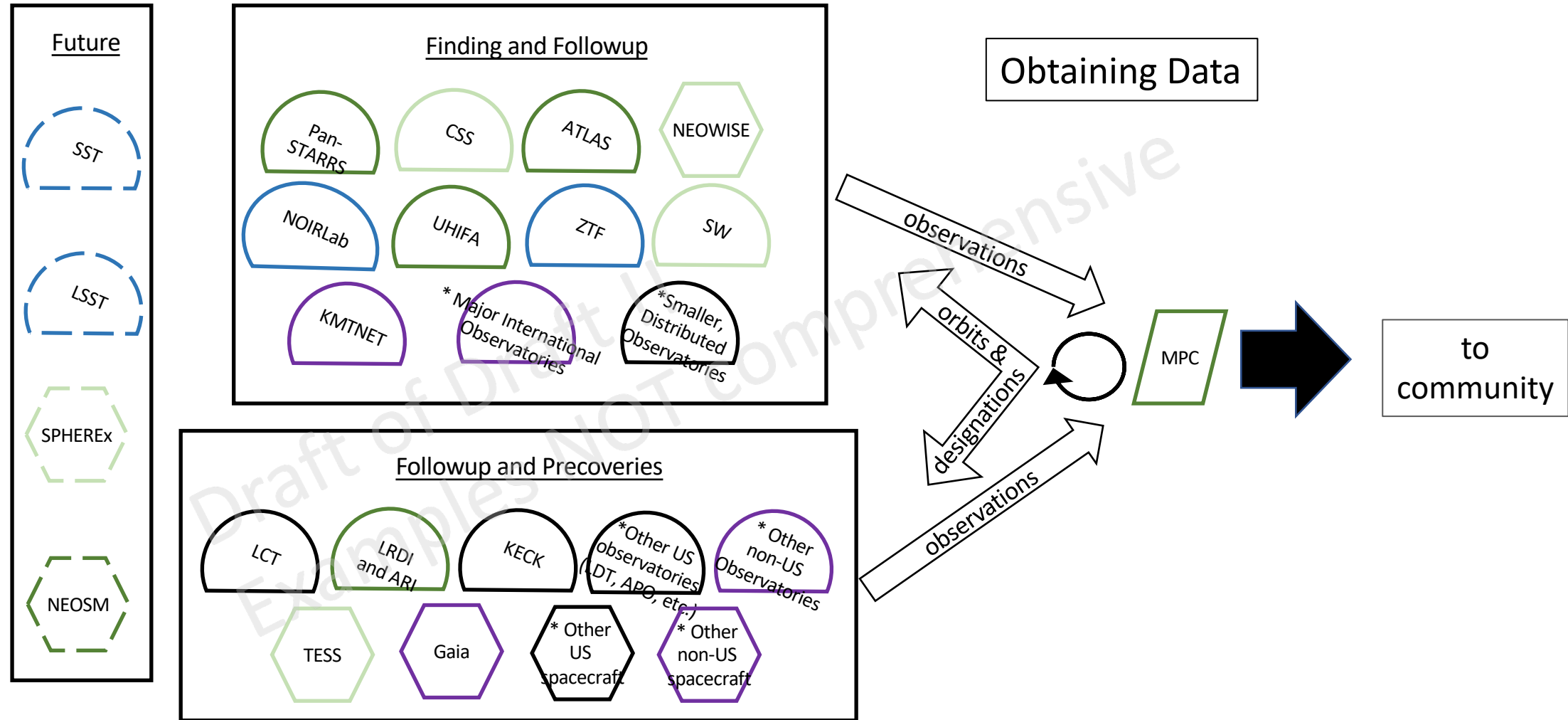
YYYY-MM-DD - latest record is older than 1 day

YYYY-MM-DD - latest record is less than 1 day old

SBN Oversight Activities include:

- Intermediate between MPC and PDCO.
- Help Organize and participate in MPC pipeline reviews, MUG meetings, Tag-ups and coordination meetings.
- Participate in Drafting Agendas and Documentation (e.g. MOUs, etc.).
- Help Track Development and Operations: Schedule, web usage, and requirements tracked by SBN's Pat Lawton with help from MPC.
- Lend a hand, e.g. System's Engineering activities, etc.

Example 1: Mapping The MPC Eco-system



Updating inventory of Inputs and Dependencies at the MPC, to determine which products to retire.

Example 2 - Product Retirement

- Several products created by the MPC are extremely specialized and little-used by the community.
 - These are ancillary to the MPC's required activities
 - Require disproportional effort to track and produce
- Critical Steps
 - Identify which are little-used,
 - notify the community of their upcoming retirement,
 - eliminate from the product list.

discussion!