



National Aeronautics and
Space Administration

Jet Propulsion Laboratory
California Institute of Technology
Pasadena, California



Surface Water and Ocean Topography (SWOT) Mission

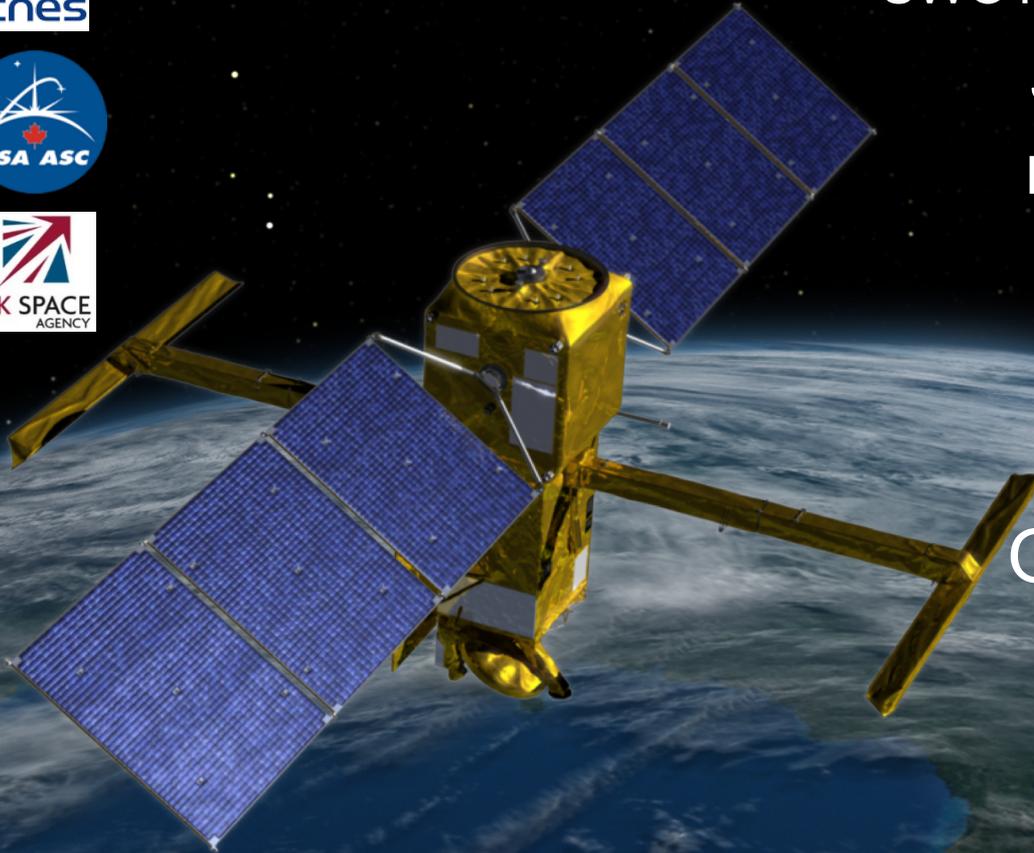
SWOT Science Team Meeting

June 26-29, 2018

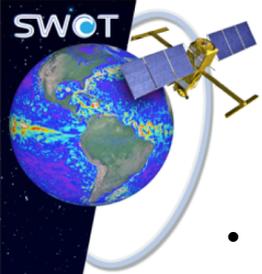
Montreal, Canada

Ocean Cal/Val Meeting
Introduction

Curtis Chen, Nicolas Picot



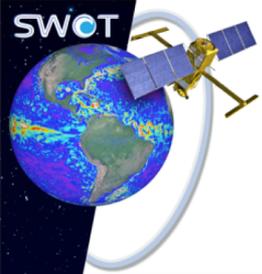
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Cal/Val Objectives

- Basic objectives of Cal/Val¹:
 - Calibration: Estimate calibration parameters for ground processing based on flight data
 - Error budget validation: Validate measurement performance (“*Does system behave as expected, and if not, what can/should we do?*”)
 - Data product validation: Validate measurement with respect to high-level requirements (“*Does performance meet mission success criteria?*”)
- Different sources of data may be useful for different Cal/Val objectives
 - Direct measurements of quantities related to SWOT measurement physics may best demonstrate that measurement performance is as expected—or enable diagnosis of problems if measurement performance is not as expected
 - Direct measurements of quantities of oceanographic science interest may best establish link between SWOT measurements and science objectives underlying SWOT requirements

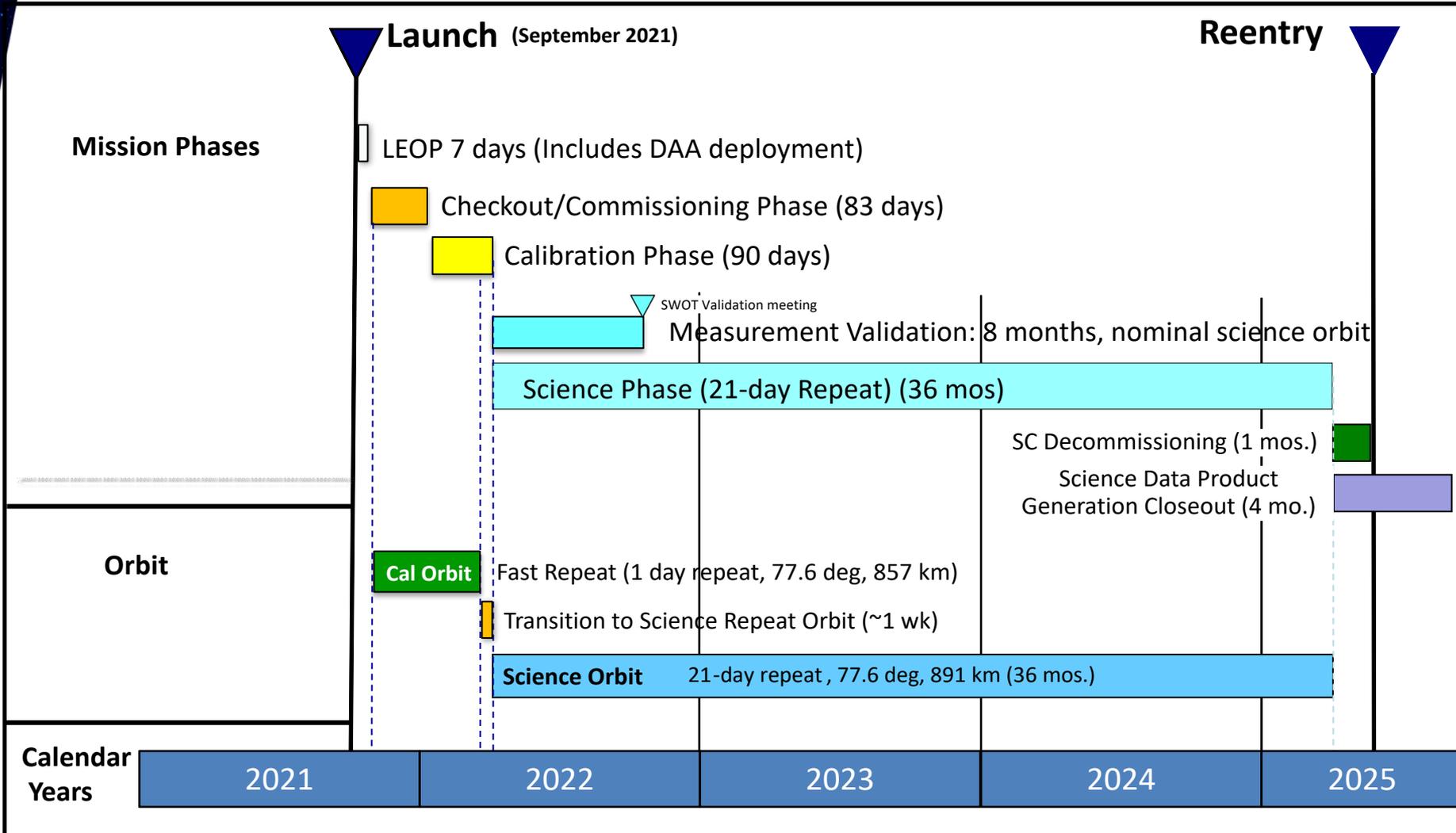
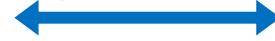
¹ SWOT Cal/Val Plan, Sects. 1.2-1.3

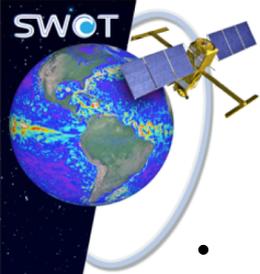


Mission Phases/Timeline

Primary Cal/Val Period

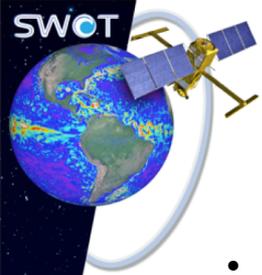
Long-term (low-level) validation





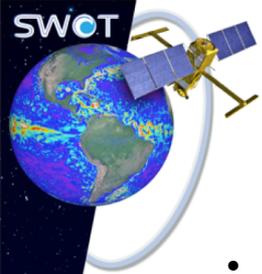
Status as of 2017 Toulouse Cal/Val Meeting

- Airborne lidar and hydrographic in situ concepts were proposed but needed to be matured and fully validated via pre-launch ocean experiments
 - Toulouse meeting occurred during Monterey Bay in situ experiment
 - Availability of suitable aircraft was major issue for airborne lidar
- GPS buoys were discussed and showed some promise; planning for US efforts on GPS buoys was to be folded into in situ activities
 - Due to cost uncertainty, were not proposed as stand-alone approach
 - Continue to leverage on-going development and test for other projects
- Global statistical approaches could likely validate wavelengths as short as 50-70 km, though validation to 150 km by local (in situ or airborne) approaches would still be preferred
- California Cal/Val site would be primary US project site
- Mediterranean activities were to continue
- Follow-on science activities were to be coordinated external to Cal/Val group



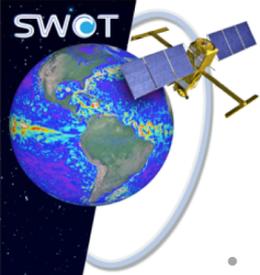
Programmatic Context

- Cal/Val plan released as JPL document (D-75724) in January 2018
 - Includes both airborne lidar and hydrographic in situ activities
- Cal/Val status and plans have been formally reviewed
 - Pre-PDR Measurement Review (Feb 2016)
 - Pre-CDR Measurement Review (Dec 2017)
 - Project CDR (Feb 2018)
 - ◆ Ocean Cal/Val received request for action (RFA) from board to complete glider and lidar validation
 - ◆ RFA did not take exception with plan, but action was to carry out plan



Meeting Objectives

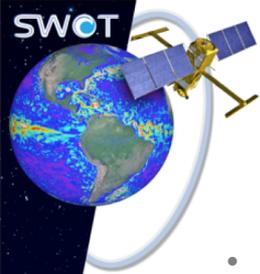
- Discuss big picture of how different Cal/Val approaches fit together in order to guide and prioritize future efforts:
 - Provide status on major ocean Cal/Val activities:
 - ◆ US in situ activities (hydrographic and GPS)
 - ◆ US lidar activities
 - ◆ French/European in situ activities & French lidar activities
 - ◆ Bass Strait absolute sea level in-situ activities
 - ◆ Global statistical approaches
 - Discuss additional approaches and sources of data (“adopt a crossover”)
- Discuss technical feasibility and risks associated with individual approaches and identify risk mitigations
 - Ability of proposed approaches to collect data of sufficient accuracy
 - Ability to interpret and inter-compare SWOT and other data sets
 - Robustness of approaches to launch date changes, logistical challenges, etc.



Timeline of US Cal/Val Plans

- Mid 2017: Monterey Bay experiment (in situ hydrographic, GPS collection)
- Mid 2018: Peer review of plans for pre-launch in situ campaign
- Early 2019: Execute pre-launch in situ campaign at California Cal/Val site
 - Date set to match season of Cal/Val phase given launch slip
- Mid 2019: Execute pre-launch lidar campaign on Gulfstream V aircraft
 - Date based on aircraft readiness
- Note: in situ and lidar plans have been decoupled to reduce logistical risk
 - Objectives of pre-launch lidar and in situ campaigns are sufficiently orthogonal
- Late 2019: Refine post-launch Cal/Val plans based on experience from pre-launch campaigns

- Early 2022 (L+3 months to L+6 months): Post launch Cal/Val at California crossover site



Timeline of French/European Cal/Val Plans

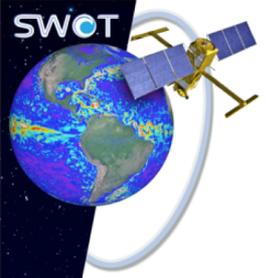
- May 2018 - Pre-SWOT Western Mediterranean cruise
- Fall 2018 - Lidar ocean flights along altimeter groundtracks (L. Froideval)
- Early 2022 (L+3 months to L+6 months): Post launch Cal/Val at chosen crossover sites (Mediterranean Sea, SW Pacific, ...)

Ongoing activities :

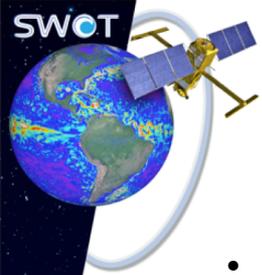
- Pre-launch preparation of global statistical CalVal activities
- Satellite product support for international « Adopt-a-crossover sites »

Future plans :

- Potential synergy with other satellite campaigns or Calval projects : e.g. CFOSAT, SKIM (in situ campaign in October 2018 off French coasts).
- 1day Xovers : assess SSH variability, SWH & Sigma0 mean values and variability, MSS/Tides/DAC quality, internal tides amplitudes; ...
- Continue working on LRM and SAR processing methods improvement to contribute to SWOT validation



Backup



SWOT CDR RFA 3: Cal/Val Plan

- Originators: Gregg Jacobs and Michael Dettinger (SWOT Project CDR Part I, 2018-02-15)
- Description:

“Not all measurement systems have been validated for cal / val, and there are plans for validate the systems. Any delays in validating the MASS lidar and underwater gliders as cal / val tools will inhibit progress in cal / val activities to support the missions.”
- Recommended Action:

“Ensure that the MASS and gliders instruments are validated as quickly and sufficiently as possible to not delay cal / val plans, activities, or other SWOT elements that may have derived requirements.”