

Addendum 2: Data Curation Data and Analytics

12.2 Data Curation Data & Analysis

A. *Curation Data Sets*

- a. (Threshold) The Provider shall provision necessary sources of unclassified Calibration Satellite (CALSAT) sufficient to assess sensor calibration and satellite tracking quality. The JCO will provide access to some GEO and LEO sources, and facilitate access to both Hyperion reference orbit folder on space-track and TDRS data on spacetrack. Additional Provider sources are encouraged.
 - i. In PWS response, Provider shall document what additional sources of Data Curation they can utilize for purposes of JCO support. (i.e., Wide Area Augmentation System (WAAS), International Laser Ranging Services (ILRS), or others)
 - ii. In PWS response, Provider shall document the timeliness it has access to additional CALSAT sources (i.e., real-time, 12-hour delay, 24-hour delay, etc)
 - iii. In the PWS response, Provider shall document what they understand the accuracy of their data calibration CALSAT source to be variance to truth.
- b. (Threshold) The Provider shall conduct data curation assessment of the JCO sensor systems performance to determine quality. At a minimum this shall include:
 - i. Comparison of JCO-derived product State Vectors and TLEs with any surveillance provider and Orbit Analyst (OA) tool suites, including:
 1. Trending of magnitude range variance over time
 2. Trending of common orbit elements (corrected to the same reference frame):
 - a. Inclination
 - b. Right Angle of Ascending Node (RAAN)
 - c. Semi-major Access (SMA)
 - d. Argument of Perigee
 - e. Eccentricity

f. Mean Anomaly

c. (Objective) Comparison shall include space-based sensor data.

d. (Objective) The provider shall include the state vector covariance values in the state vector accuracy assessments to compensate for post maneuver short orbit fits.

e. (Threshold) The Provider shall generate noise and bias results for each optical sensor:

- i. Current RA/DEC Noise and Bias value (arc seconds)
- ii. 2-week average RA/DEC Noise and Bias value(s) (arc seconds)
- iii. Current timing bias (sec)
- iv. 2-week average timing bias (sec)
- v. Note: Sensor Biases: Biases are computed for angle, range, and range-rate components and are based on the mathematical mean of the calibration observation residuals.

f. (Objective) Noise and bias results shall be provided for space-based sensor data.

g. (Objective) The Provider will publish UDL "Notifications" of Message Type "DataCurationFlagReport" when surveillance provider sensors are found to exceed JCO-defined tolerance. Notification shall contain all applicable data fields (work with JCO/Dragon Army for specific format):

- i. Sensor ID
- ii. Provider
- iii. Sensor Noise (arcsec)
- iv. Sensor Bias (arcsec)
- v. Timing Noise + Bias (sec)
- vi. Range Bias (m)

h. (Threshold) The Provider shall notify the sensor or orbit state provider and the C2 team in JCO chat or voice systems of any sensor or orbit state that is exceeding tolerance, or trending off of precision ephemeris data. Provider shall support sensor, fusion provider and JCO trouble-shooting of sensor or fusion data errors.

- i. (Objective) The Provider shall populate the UDL sensor calibration schema to inform fusion providers on specific sensor error values.
- j. Conditions to trigger ‘DataCurationFlagReport’ include:

Surveillance Property	Value	Units	Applicable Type
Timing Accuracy	.004	Seconds	Optical & Radar
Angles Sigma	5, 10 by exception	Arc Seconds	Optical
Angles Sigma	360	Arc Seconds	Radar
Range Sigma	30, 40 by exception	Meters	Radar
Range/Rate Sigma	5	Meters/Seconds	Radar
TDOA RMS	50	Meters	Passive RF
FDOA RMS	0.3	Meters/Seconds	Passive RF

- k. (Threshold) – if active data curation services are provided. All data – including processed products - will be published in appropriate JCO databases, as a default.
- l. (Threshold) – if active data curation services are provided. A company will not be eligible for consideration for Active Data Curation Provider if they are also a surveillance provider for commensurate real-world data or a data fusion provider; due to the fundamental organizational conflict of interest in assessing competitor data and/or analytical products while providing similar products.

B. Operational Assessment Quick-Look Status

- a. (Objective) Active data curation providers shall also provide quick-look metrics assessments for overall JCO operational performance at every JCO stand-up and upon request by JCO C2. This involves the assessment of all operational providers in aggregate against the following requirements for operations:

- i. (Objective) High Rate Revisit (HRR) performance by orbit regime by tasking priority level – this includes highlighting revisit rate intervals and gap times.
- ii. (Objective) Gaps in data receipt.
- iii. (Objective) Gaps in collection or coverage.
- iv. (Objective) Delays or gaps in data receipt, especially in accordance with a sensor collection plan or tasking priority.
- v. (Objective) Delays in operational NOTSO reporting times.

C. Data Support Analyst Services

- a. (Threshold) As necessary to provide any additional augmentation to facilitate data integration and/or interpretation of the curation data, the Provider shall deliver up to one (1) full time equivalent (FTE) of a qualified space operations analyst to remotely support the Joint Commercial Operations Cell. This analyst will be on shift during normal business hours, Monday through Friday. A thirty-minute break is included during the operations period. The Joint Commercial Operations effort will recognize all local Government holidays. The Provider is expected to staff positions matching the above-referenced schedule. This support will be conducted in a format similar to the live ops practice events and demo days (e.g., ICS, ICT, live practice periods). An analyst will take direction during the shift from the JCO C2 leads or government-appointed lead. An analyst may contribute to mission operations in a variety of ways as time permits, including support to JCO/DOK and the AFRL Dragon Army.
- b. (Threshold) Nominal duty station will be conducted through remote teleconferencing system (i.e. Zoom, Microsoft Teams, or other). The analyst normal duty station will be at Provider facility or off-site location. This task will not require travel and the Provider should not propose Other Direct Cost (ODC). Shift work may include periodic on-site stationing at a regional facility for JCO if 1) analyst(s) are local to the regional facility and 2) both the Provider and Government Site Lead approve.
- c. (Threshold) Analyst will continuously monitor the JCO Chat and/or JCO Zoom throughout normal hours of operation for an assigned shift (Americas, Pacific, Meridian, split-shift). JCO-Americas operating time is 1500Z / 0800 Mountain Time (MTN) to 2300Z / 1600 MTN. JCO-Pacific operating time is 2300Z to 0700Z and JCO-Meridian operating time is 0700Z-

1500Z in the period of performance. 30 min is required for changeover receipt on the front end of the time periods.

- d. (Objective) Analyst will be available to support another JCO Global site (Pacific, Meridian, Split-Shift) for 8.5 hours (including operations period and change-overs).
- e. (Objective) Additional support includes support to JCO/DOK for accuracy assessments of new sensor or fusion provider performance being integrated into the JCO. This includes state and sensor accuracy assessments and HRR collection performance.
- f. (Objective) Provider shall provide analysis of maneuver alerts in UDL with an intent to support accuracy and timing assessments of alerts and support JCO/DOK in defining alerting criteria for maneuvers. In addition provider shall support DOK in establishing maneuver reporting guidelines and accuracy requirements.
- g. (Objective) Provider shall support JCO/DOK in the definitions and adjustments of sensor and fusion provider accuracy requirements to support diverse mission sets (custody, change detection, orbit accuracy needs) with the intent to drive development of JCO Data Requirements Documents for each sensor phenomenology and state accuracy for mission sets. Provider shall support investigation into state accuracy based on relaxed sensor thresholds.
- h. (Objective) Provide shall support JCO/DOK in the standardization of data delivered to the UDL in support of JCO operations focused on metric observations and state information. This support includes documentation of fundamental technical components that require standardization in the JCO.

D. Deliverables

Description	Frequency
Active Data Curation	NRT through PoP
Space Operations Analyst Support – 1 FTE	8.5-hour shifts/5 days per week

Monthly status reports (MSR) emailed to designated JCO Global Coordinator, Program Management Office, and JCO Ops Integration	Monthly, by the 10th of each month
Sensor Noise and Bias Failure Reports	As Needed