Before the
Federal Communications Commission
Washington, DC 20554

In the Matter of Silkwave Africa LLC Application to Modify Authorization for Silkwave 2 (formerly known as AfriStar-2)	File No. SAT-LOA-20050311-00061 Call Sign: S2666

APPLICATION OF SILKWAVE AFRICA LLC TO MODIFY AUTHORIZATION FOR SILKWAVE 2

Silkwave Africa LLC ("Silkwave"), pursuant to Section 25.117 of the Federal Communications Commission's ("FCC" or "Commission") rules,[1] requests approval to modify its authorization to launch and operate Silkwave 2, formerly known as AfriStar-2, at the 21.0° E.L. orbital location. Specifically, Silkwave seeks authority to (1) operate in the entire 1452-1492 MHz band, subject to ITU requirements, to provide downlink Broadcast Satellite Service (sound) ("BSS (Sound)") services; (2) increase EIRP and EIRP density parameters; and (3) extend the time allowed to construct and launch Silkwave 2 until December 2022. Grant of this application would enable Silkwave, which de-orbited its legacy satellite following an unexpected failure of the spacecraft's thrusters, to restore BSS (Sound) services to consumers in the Middle East, Africa, and Southern Europe from the 21.0° E.L. orbital location.

I. INTRODUCTION AND BACKGROUND

Silkwave intends to restore BSS (Sound) services to the Middle East, Africa, and Southern Europe through the Silkwave 2 satellite, the authorization for which Silkwave acquired

[1] 47 C.F.R. § 25.117.

in 2017. The FCC granted authority in 2006 for AfriSpace, Inc., a wholly-owned subsidiary of WorldSpace, Inc., (hereinafter "WorldSpace") to launch and operate the Silkwave 2 satellite from 21.0° E.L.[2] WorldSpace intended for the Silkwave 2 satellite to replace its existing L- and X-band BSS (Sound) satellite at 21.0° E.L., AfriStar-1. Like AfriStar-1, Silkwave 2 would provide BSS (Sound) services using the 1452-1492 MHz (space-to-Earth) band and corresponding feeder links in the 7025-7075 MHz (Earth-to-space) band. However, because Afristar 2 has a substantially different coverage area than AfriStar-1, the FCC considered and granted WorldSpace's application as a request for new authority rather than as a replacement satellite.[3]

The 2006 grant authorized WorldSpace to launch and operate the Afristar-2 satellite at the 21.0° E.L. orbital location and to co-locate it with AfriStar-1. The FCC permitted WorldSpace to operate service downlinks in the 1452-1492 MHz band "within 2.6 megahertz of spectrum in each polarization with a center frequency of 1479.5 MHz" and peak EIRP of 59.8 dBW, operate service uplinks in the 7025-7075 MHz band, and operate telemetry, tracking, and command ("TT&C") links at a center frequency of 1491.7 MHz.[4] The Commission waived Section 25.210(c) technical requirements regarding transponder saturation flux densities.[5] It also waived Sections 25.164 and 25.165(a)(2) milestone and bond requirements.[6] Under the

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2 *AfriSpace, Inc. Application for Authority to Launch and Operate a Replacement Satellite, AfriStar-2, at 21° E.L. and to Co-Locate ith with AfriStar-1*, Order and Authorization, 21 FCC Rcd 17 (2006) ("*2006 Order*").

3 *2006 Order*, ¶¶ 1, 8.

4 *2006 Order*, ¶¶ 33-37.

5 *2006 Order*, ¶¶ 20-22, 39.

6 *2006 Order*, ¶¶ 26-29, 42-43.

conditions of the grant, WorldSpace was required to place Afristar-2 into operation prior to the removal of the AfriStar-1 satellite from service.[7]

In 2008, and before WorldSpace could launch Afristar-2, WorldSpace and its affiliates filed voluntary petitions for reorganization under Chapter 11 of the U.S. Bankruptcy Code. As part of that reorganization, the FCC granted and the Bankruptcy Court approved assignment of the AfriStar-1 and Afristar-2 licenses in 2010 from WorldSpace to Yazmi USA, LLC ("Yazami").[8] Silkwave acquired the licenses from Yazami in 2017—11 years after authorization of the Afristar-2 satellite and 7 years after the bankruptcy proceedings.[9]

When Silkwave acquired the Afristar-1 and Afristar-2 assets, AfriStar-1 was operating in inclined orbit with limited power, bandwidth, and spectral efficiency, and construction on Afristar-2 had not begun. At least half the payload power of AfriStar-1 was functioning according to Intelsat Corporation ("Intelsat"), the contractor managing TT&C operations for the spacecraft.[10] Intelsat estimated based on the fuel remaining that AfriStar-1's Operating Maneuver Life ("OML") would last until June 2021.[11] Although the AfriStar-1 satellite had several anomalies, there was no indication that the spacecraft would not function until fuel depletion in 2021.

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7 *2006 Order*, ¶ 43.

8 Assignment of AfriStar-1 (S2367) and AfriStar-2 (S2666) from AfriSpace, Inc. Debtor-in-Possession to Yazmi USA, LLC, IBFS File No. SAT-ASG-20100604-00123 (granted July 29, 2010).

9 Assignment of AfriStar-1 (S2367) and AfriStar-2 (S2666) from Yazmi USA, LLC to Silkwave Africa, LLC, IBFS File No. SAT-ASG-20161025-00101 (granted Jan. 10, 2017).

10 *See* Appendix 1 at 4.

11 *See* Appendix 1 at 3.

In January 2018, Silkwave de-orbited AfriStar-1 out of an abundance of caution following an unexpected failure of the spacecraft's primary attitude control thruster. During a normal station-keeping maneuver on November 29, 2017, Silkwave's primary thruster became inoperable and caused a loss of earth pointing. Silkwave used its backup thruster to regain the attitude control of the spacecraft in sun hold mode, while an extensive investigation ensued. Silkwave learned from Airbus, the satellite's manufacturer, that there was a product line issue with thruster seals, which affected several satellites including AfriStar-1.[12] Airbus also determined that AfriStar-1's primary thruster failed completely and could not be restored.[13] Further, the backup thruster showed degraded performance in early 2012 and would be used for contingency purposes only. Out of an abundance of caution and concern for fellow satellite operators, Silkwave made the decision to decommission AfriStar-1. If the backup thruster failed, station-keeping and pointing would not be possible. Afristar-1 would drift uncontrollably, becoming an in-orbit debris to neighboring satellites. Although Silkwave risks losing ITU frequency priority if the 21.0° E.L. orbital location is vacated for more than three years and repercussions for failing to bring Afristar-2 into service before decommissioning AfriStar-1, it believes that safety is paramount.

Silkwave has worked to expedite the construction and launch of Afristar-2 since de-orbiting AfriStar-1. Silkwave has successfully performed extensive technical trials of its new, converged technology using its AsiaStar satellite at 105.0° E.L. and 4G networks in Asia. These trials included 400 concept-cars, trucks, and SUVs with more than 10 original equipment manufacturer ("OEM") partners. The trials accumulated over 80,000 hours of road-tests across

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12 *See* Appendix 1 at 6.

13 *See* Appendix 2.

one million kilometers of travel through 14 provinces and 16 cities in Asia. Silkwave had planned to carry out similar technical trials in Africa and the Middle East during 2018, prior to the failure of AfriStar-1. Silkwave also completed its Request for Information ("RFI") process in 2018, receiving comments from Lockheed Martin, Thales, Space System Loral, and Airbus. Silkwave will shortlist the manufacturers and issued a Request for Proposals ("RFP") in the Q3 2019. Silkwave plans to award the satellite contract in Q4 2019. Based on proposed delivery schedule commitments from manufacturers, Silkwave expects to launch the Silkwave 2 satellite in Q4 2022.

Silkwave 2 will provide improved services to consumers using Silkwave's new, converged system. The Silkwave system will leverage both the Silkwave 2 satellite and existing and emerging terrestrial wireless networks. While the Silkwave 2 satellite will serve as the primary distribution point for digital audio programming, terrestrial networks will act as repeaters and can retransmit signals lost in the "urban shadow" or blocked by mountainous terrain. The converged network combines the economic benefits of high-performance satellite technology with the flexibility of terrestrial cellular networks—capitalizing on the advantages of each.

II. PROPOSED MODIFICATION

Silkwave requests FCC approval to modify its existing authorization to bring next-generation BSS (Sound) services to Africa, the Middle East, and Southern Europe. Silkwave intends not only to restore service, but also offer improved coverage and service quality to these regions using its converged satellite and terrestrial technology system. Accordingly, Silkwave seeks authorization to (1) utilize the entire 1467-1492 MHz band to provide downlink services; (2) increase EIRP and EIRP density parameters; and (3) extend the time allowed to construct and launch Silkwave 2 as late as December 2022.

A. 1452-1492 MHz Band Operations

Silkwave seeks approval to utilize the entire 1452-1492 MHz band to provide downlink BSS (Sound) services, subject to compliance with ITU Resolution 528 of the 1992 World Administrative Radio Conference ("WARC-92") and ITU Recommendation ITU-R F.1338. These are same frequencies licensed to AfriStar-1 at 21.0° E.L. and the same frequencies requested by WorldSpace in its application to launch and operate Afristar-2. However, because WorldSpace indicated in its application that it would use only a subset of these frequencies, the Commission limited authorization to "2.6 megahertz of spectrum in each polarization with a center frequency of 1479.5 MHz."[14] To employ its new, converged technology system, Silkwave requires use of the full 1452-1492 MHz band and accordingly seeks FCC approval to operate across all frequencies subject to ITU rules.

Authorizing operations in the 1452-1492 MHz band will provide greater flexibility to Silkwave without increasing the risk of interference. Silkwave will limit operations to the upper 25 megahertz of the band (*i.e.*, 1452-1492 MHz) pending conclusion of the ITU planning conference for the 1452-1467 MHz frequencies, consistent with Resolution 528. Silkwave will also ensure any future operations in the 1452-1467 MHz frequencies comply with BSS (Sound) and Fixed Service ("FS") sharing requirements in ITU-R F.1338. Operations in the lower portion of the L-band would occur only after extensive coordination with affected satellite and FS operators and in compliance with ITU rules and recommendations.

B. Increase EIRP and EIRP Density Parameters

Silkwave requests approval to increase its EIRP to 70.8 dBW and EIRP density to -3.2 dBW/Hz or the maximum EIRP and EIRP density allowable through ITU coordination to

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[14] Order para 1, 33-34.

deliver higher digital data transmission. Spacecraft payload technology improvements made over the last decade allow new ground user terminals and devices to receive large amounts of data through a given bandwidth. The rate of data transfer is a function of power and bandwidth. Because Silkwave must limit operations to the upper 25 megahertz of the 1452-1492 MHz band pending conclusion of the ITU planning conference, increased EIRP and EIRP density parameters are required to meet consumer demand. As Afristar-1 was operating with the same uplink and downlink frequency spectrum since 2000, the risks of harmful interference to neighboring satellite systems is low. Silkwave nevertheless commits to coordinating with all potentially affected operators prior to bringing the frequencies into use.

C. Extend Time to Construct and Launch Silkwave 2

Silkwave requests FCC approval to extend the time allowed to bring Silkwave 2 into operation until December 2022. When the Commission authorized WorldSpace to launch and operate Afristar-2 in 2006, it conditioned grant upon WorldSpace constructing, launching, and operating the satellite before decommissioning its existing AfriStar-1 satellite. Silkwave only acquired the AfriStar-1 and Afristar-2 authorizations in 2017. At that time, as explained above, Silkwave reasonably expected that AfriStar-1 would operate until exhausting OML fuel in 2021. Silkwave could not have anticipated that the spacecraft's primary thruster would fail due to a manufacturing error. Rather than rely on its secondary thruster, Silkwave made the decision to immediately de-orbit AfriStar-1. Because of this decision, Silkwave was unable to place Silkwave 2 into operation prior to the removal of AfriStar-1 from service.

When reviewing requests for extension of time, the FCC considers "the totality of circumstances—those efforts made and those not made, the difficulties encountered and those

overcome, the rights of all parties, and the ultimate goal of service to the public."[15] The Commission has routinely granted extension when the delay is due to circumstances beyond the control of the licensee or has demonstrated intent to proceed with a modified system.[16]

Good cause exists to extend the time allowed for Silkwave to construct and launch the Silkwave 2 satellite. Silkwave has made significant progress towards the realization of the Silkwave 2 satellite notwithstanding circumstances beyond its control. The AfriStar-1 anomaly forced Silkwave to adjust its preparations for the Silkwave 2 satellite. Unable to conduct planned technical trials on the AfriStar-1 satellite, for example, Silkwave made accommodations to test its converged technology using its AsiaStar satellite at 105.0° E.L. With testing complete, Silkwave is working diligently to construct and launch Silkwave 2. It has already completed the RFI process, plan to release the RFP, and plans to award the satellite contract by Q4 2019. Silkwave expects to launch the Silkwave 2 satellite in Q4 2022, based on preliminary commitments by satellite manufactures. Silkwave has made significant investment, both monetary and otherwise, to launch and operate Silkwave 2, restoring BSS (Sound) services to consumers in Africa, the Middle East, and Southern Europe from the 21.0° E.L. orbital location. Accordingly, extension of time would serve the public interest.

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15 *EchoStar Satellite Corporation Application for Extension of Time to Construct, Launch, and Operate a Direct Broadcast Satellite System*, Order, 11 FCC Rcd 3017, ¶ 12 (1996).

16 *See*, e.g., *GE American Communications, Inc., Request for Extension of Time to Construct, Launch, and Operate a Ka-band Satellite System in the Fixed-Satellite Service*, Order and Authorization, 16 FCC Rcd 11038 (2001) (granting up to 3-years extension to allow GE To incorporate inter-satellite links into its system); *Intelsat LLC Request for Extension of Milestone Dates for the INTELSAT 10-02 (INTELSAT Alpha-2) Satellite*, Memorandum Opinion and Order, 19 FCC Rcd 5266 (2004) (granting an extension due to unexpected testing and launch delays); and *Intelsat LLC Modification of Authorization to Launch C-band and Ku-band Satellites that Form a Global Communications System in Geostationary Orbit*, Order and Authorization, 17 FCC Rcd 2391 (2002) (granting an extension to correct unforeseen technical problems with the spacecraft).

III. MILESTONE AND BOND REQUIREMENTS

Silkwave requests extension of the previously granted waiver of the milestone and bond requirements, codified in Sections 25.164 and 25.165(a)(2) of the FCC's rules,[17] for the Silkwave 2 satellite. Under Section 1.3 of the FCC's rules, the Commission has authority to waive its rules "for good cause shown."[18] Good cause exists if "special circumstances warrant a deviation from the general rule and such deviation will serve the public interest" better than adherence to the general rule.[19] In determining whether waiver is appropriate, the Commission should "take into account considerations of hardship, equity, or more effective implementation of overall policy."[20]

Good cause exists to continue waiver of the milestone and bond requirements. The FCC appropriately reasoned that there are sufficient incentives to ensure that Silkwave 2 is deployed in a timely manner to prevent the warehousing of orbital and frequency resources.[21] At that time, the frequencies and orbital location requested were already in use by the AfriStar-1 satellite. Although AfriStar-1 is no longer in service, strong incentives remain. Silkwave risks losing rights to use these frequencies under ITU rules, if it does not bring the now dormant frequencies back into use in a timely manner. Benefits of bringing the satellite into use therefore outweigh any potential gain from holding the spectrum idle. In addition, Silkwave has invested significant resources to construct and launch Silkwave 2, demonstrating that Silkwave's application is not speculative. This investment comes at a time when Silkwave is already facing

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17 47 C.F.R. §§ 25.164, 25.165(a)(2).

18 47 C.F.R. § 1.3; *WAIT Radio v. FCC*, 418 F.2d 1153, 1159 (D.C. Cir. 1969).

19 *Northeast Cellular Telephone Co. v. FCC*, 897 F.2d 1164, 1166 (D.C. Cir. 1990).

20 *WAIT Radio*, 418 F.2d at 1159.

21 *2006 Order*, ¶¶ 26-29.

the financial hardships of lost service revenue due to the unexpected failure of the AfriStar-1 satellite. Accordingly, the Commission should extend its previously granted waiver of the milestone and bond requirements.

IV. GRANT OF THIS APPLICATION WILL SERVE THE PUBLIC INTEREST

Grant of this application will serve the public interest by restoring BSS (Sound) services to consumers in the Middle East, Africa, and Southern Europe who previously received service from the AfriStar-1 satellite at the 21.0° E.L. orbital location. Moreover, the restored services will be a dramatic improvement from prior services. Silkwave's new, converged technology system will utilize capabilities from satellite and terrestrial networks alike to deliver reliable, high-quality digital audio content to consumers throughout the coverage area. The Silkwave 2 satellite will distribute programming, and terrestrial cellular networks, acting as repeaters, will provide supplemental coverage to areas without line-of-sight to the satellite. Consumer will thus enjoy the benefits of both high-performance satellite technology and ubiquitous terrestrial cellular networks.

V. CONCLUSION

Based on the foregoing, Silkwave respectfully requests that the Commission grant this modification application.

Respectfully submitted,

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Appendix 1
Afristar Monthly Operational Status Report by Intelsat for October 2017

STATUS REPORT

Worldspace W01
(Afristar - 21E)

REPORTING PERIOD:
October 1 through October 31, 2017

1.0 SUMMARY:

Worldspace W01 – Afristar provided quality service through this reporting period.

New Service Impacting Anomalies:
- DC/DC Converter 2 SSO (10/09 @ 0236z). Processed payload outage from 0236z-0430z.

New Non-Service Impacting Anomalies:
- None

Closed Anomalies:
- None

Operations:
Routine operations continued as normal.
- S/K maneuvers and ranging.
- IRES Blinding loads.
  IRES Blindings performed via Time Tagged Queue.
  Manual IRES Scan Procedures for backup operations to TTQ.
- Orbital Oscillator Update performed (10/11).

Routine periodic activities performed in this period were:
- Redundant Gyro Calibration (10/25)

Non-periodic activities performed in this period were:
- Transparent payload restoral after DC/DC Converter 2 SSO (10/09).

2.0 LIFE PROJECTIONS AND EXPECTATIONS:

2.1 Solar Array/Battery

- No degradation of EPS subsystem during this reporting period.
- Fall Eclipse Loading: Spring delayed delatch margin of 2A on Bus 1 and Bus 2 for Sat-Y anomaly operations (Eclipse Exit Heater Operations) remains. Fall Eclipse Season operations to be provided prior to season start.

2.2 Propulsion:

- The satellite was launched in October 1998. The current predicted End of Life / Operational Mission Life (EOL/OML) estimate is June 2021 without Inclination control. The OML date assumes a 150 Km deorbit altitude with no station changes.
  - Estimated Inclination at EOL in June 2021 is 6.5 deg.

2.3 Spacecraft Inclination:

- Inclination 3.6 degrees

3.0 **PAYLOAD CONFIGURATION:**

No changes during reporting period.

UNITS COMMON TO BOTH PAYLOADS

	Number	Output Voltage	Consumption (A) / Temp Deg C
MLO	3	5.00	0.080 / 83 C
XIF Receiver	1	-	0.11

AFRISTAR PAYLOAD W01 CONFIGURATION

April 2017

TRANSPARENT PAYLOAD IF DEMULTIPLEXER — *TRANSMIT SECTION*

Chain #	Status	RX Frequency	TX Frequency	ALC	Gain Step	TDM Identified -hex-	Noise Reduction	TWTA Selection / Bus #	Feed & Polarization	Reflector & Coverage Area
DX1	ON	7031.052	1468.564	ON	**18**	1400h	Upper Band	4+6 / Bus2	**B *RHCP***	**B / NE**
DX2	OFF									
DX3	ON	7049.292	1473.164	OFF	**18**	1700h	Upper Band	10+12 / Bus2	**A1/A3 *RHCP***	**A / South**
DX4	OFF									
DX5	ON	7067.532	1487.884	OFF	**0**	1200h	Upper Band	13+15 /Bus1	**A2 *RHCP***	**A / NW**

PROCESSED PAYLOAD IF CONVERTER & BBP- RX CHAINS

Rx IF Chain #	Rx IF Conv Status	RX Frequency Mhz	BBP Rx Chain #	BBP Rx Chain Status
1	ON	7037.011	0	ON
2	ON	7040.659	1	ON
3	ON	7044.307	2	ON
4	OFF		3	OFF
5	ON	7055.251	4	ON
6	ON	7058.899	5	ON
7	ON	7062.547	6	ON
8	OFF		7	OFF

BBP& IF CONVERTER - TX CHAINS

BBP Tx Chain #	BBP Tx Chain Status and TDM ID Value (hex)	Tx IF Chain #	Tx IF Conv Status	Tx Frequency Mhz	Gain Step
0	OFF	MOD1	OFF		
1	ON	MOD2	ON	1470.864	**20**
2	ON 1600h	MOD3	ON	1475.464	**25**
3	OFF	MOD4	OFF		
4	ON 1300h	MOD5	ON	1490.184	**25**

TRANSMIT SECTION

Noise Reduction	TWTA Selection / Bus #	Feed & Polarization	Reflector & Coverage Area
Upper Band	2+3 / Bus2	**B *LHCP***	**B / NE**
Upper Band	7+9 / Bus1	**A1/A3 *LHCP***	**A / South**
Upper Band	16+18/Bus1	**A2 *LHCP***	**A / NW**

TWTA PHASE SHIFTER STATUS

TWTA	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Status	Off	On	On	On	Off	On	On	Off	On	On	Off	On	On	Off	On	On	Off	On
Outgassing	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	N	Y	Y	N	Y	Y	N	Y
Phase Set [0041 - 0058]	0	37	28	7	0	56	20	0	45	58	0	5	51	0	10	44	0	21

UNIT INTERFACES

	TM/TC	DC/DC	Consumption (A)
IF Converter	1	1	1.05
BBP	1	1	1.80
IF Demux	1	1	0.67

4.0 REDUNDANCY - Bus:

Bus Subsystem/Units	Design Redundancy	Actual Redundancy
Electrical Power (Independent North and South power bus)		
Battery Charge Interface Units	2/1	2/1
Array Switching Regulators	2/1	2/1
Solar Wing Circuits	2 x 20/19	2 x 20/19
Battery Cells	2 x 27	2 x 27
Data Handling		
Central Interface Unit	2/1	2/1
OBDH data bus	2/1	2/1
Remote Interface Unit	2/1	2/1
Payload Interface Unit	2/1	2/1
Attitude Control		
Central Processing Electronics	2/1	2/1
Earth Sensors	2/1	2/1*
Gyros	2/1	2/1
Linear Analog Sun Sensor	4/2	4/2
BiAxial Sun Sensor	6/3	6/3
Fixed Momentum Wheel	2/1	2/1
Telemetry and Command		
Command Receivers S-Band	2/1	2/1
Command Receivers X-Band	2/1	2/1
Telemetry Transmitters S Band	2/1	2/1
Telemetry Transmitters L Band	2/1	2/1
Propulsion (Redundant Subsystems)		
Tanks Fuel	2/1	2/1
Tanks Oxidizer	2/1	2/1
10 N Thrusters	See Below	
1 (N/S DeltaV and Control)	2/1	2/1
2 (N/S DeltaV and Control)	2/1	2/1
3 (N/S DeltaV and Control)	2/1	2/1
4 (E DeltaV)	2/1	2/1
5 (W DeltaV)	2/1	2/1
6 (Control)	2/1	2/1
7 (Control)	2/1	2/1
Thermal Heaters		
Battery heater set	2 x 4/2	2x 4/2
IRES heater set	2/1	2/1
FMW heater set	2 x 2/1	2 x 2/1
Propulsion heater set	See Below	
Thrusters	14 x 2/1	14 x 2/1
NTO Tanks	2 x 8/4	2 x 8/4
MMH Tanks	2 x 8/4	2 x 8/4
Line Heaters	20/10	20/10

*** IRES A – Contingency use may be possible with IRES A in IRES B failure scenario. FOR00029 created for use with CONF_TEST disabled.**

5.0 ANOMALIES

5.1 New Anomalies:

DC/DC Converter 2: SSO (10/09 0236z – 04330z).Payload restored by POC (Steve Kahler). Occasional nuisance anomaly

5.2 Status of Open Anomalies:

MOD1 – Under investigation by Airbus.
PIU1 - Under investigation by Airbus.

5.3 Status of Closed Anomalies:

None

5.4 Cumulative Anomalies:

Thruster 2B Seepage:
Thruster pair 2B/3B were swapped out for 2A/3A during the first January 2012 SKM cycle with nominal performance. Thruster pair 2B/3B are now reserved for anomaly recovery contingency and will no longer be used for SKM cycles.

PIU1 Intermittent Command Processing:
Some PIU1 commands not processed during eclipse season. A handful of commands were identified not to respond during the fall 2012 eclipse season daily payload backoff. The issue appears to be temperature related. During the solstice seasons we are unable to duplicate the PIU not processing commands.

-X Antenna Temperature Sensor Erratic:
Erratic temp sensor data (PIN I125) during eclipse season (09/01/12). Anomaly report submitted to Airbus. Expect no action for external environment temperature sensor.

IRES A Failure:
IRES A Failure - IRES B Failure contingency developed by Airbus for IRES A use in a failed IRES B scenario. FOR 00029 received (09/12/14) and contingency procedure created to use IRES A with CONF_TEST disabled after confirmed IRES B failure

+X Antenna Temperature Sensor Erratic:
Erratic temp sensor data (PIN I126) during eclipse season (09/03/15). Anomaly report submitted to Airbus. Expect no action for external environment temperature sensor. Similar to –X Temperature Sensor. Limits on I125 and I126 removed 09/18/17

ASR1 Duty Cycle Measurement Telemetry Erratic:
Erroneous TLM measurement of the ASR duty cycle (A064) at post-eclipse battery recharge termination for Battery 1. The telemetry falsely reporting 100% utilization, indicating a fully loaded Bus1 power condition. Airbus investigation concludes that this is a telemetry only anomaly due to shared telemetry conditioning circuit affecting two telemetry PINs that determine the duty cycle of ASR1.

6.0 Observations

6.1 New Observations:

- None

Appendix 2
Airbus Thruster Anomaly Analysis Summary & Recommendation

WST1 anomaly summary

- On the 29/11/2017 WST1 was performing an East CSK when an ARO triggered due to roll depointing

- CPSE A branch status
  - The depointing was due to RCT 2A failure due to Kalrez seal anomaly (refer to RCT Kalrez Seal Anomaly Summary for Worldstar 1 charts in the present document) . Coming back to CPS branch A was forbidden by CPS specialist because of the risk of disruption of the fuel film cooling and combustion chamber burn-through.
  - The CPS A branch is leaking from RCT2A and cannot be used without emptying MMH tank. In this condition, a failure on any of the B thruster highly jeopardize the capability to reorbit the satellite.

- ARE Status
  - By the meantime the ARE board failed so no more FDIR was available on-Board. The attempt to switch it ON again failed.

- CPSE B branch status
  - Furthermore, thruster's performances degradation on RCT2B and 3B were already identified in the past and confirmed during the analyses for reorbiting the satellite (Refer to WST1 – RCT2B and RCT3B performance assessment charts in the present document).
  - Any pulse on these thrusters put them at risk.

➔ So Airbus recommended to reorbit the satellite while it is still conceivable

AIRBUS

Thruster Functions

Function	Thrusters	Function	Thrusters
Roll -	1	Liquid conditioning and LAE backup	6 + 7
Roll +	2 + 3		
Pitch -	6		
Pitch +	7	NSSK	1 + 2 + 3
Yaw -	2 + 1	ESK	4
Yaw +	3 + 1	WSK	5