Introduction to the Solid State Based Interior Lighting System for ISS

James.c.Maida@nasa.gov

SF3

NASA  JSC
Introduction

Solid state lighting assembly (SSLA) were designed to replace general luminaire assembly (GLA) for both general interior illumination and improved circadian rhythm through melatonin control using multiple spectrums.

To accomplish these goals, the light is design to operate in 3 modes with 3 distinct spectrum. The different spectrum provide control of the blue portion of the light which impacts melatonin production in humans which impacts sleep.

General mode is a 4500K “neutral” light spectrum intended to be the default mode of operation for day to day operations.

Pre-sleep mode is a 2700K “warm” light spectrum intended to be used by the crew at the end of the work day.

Phase-shift mode is a 6500K “cool” light spectrum intended to be used for altering the crew’s sleep patterns.
General mode spectrum is broad. It has a correlated color temperature of 4500K. It is intended to be neutral in suppression of melatonin.

Higher spike suppressing melatonin, increases alertness

Higher spike in red and yellow regains balances the blue spike

General mode spectrum is broad. It has a correlated color temperature of 4500K. It is intended to be neutral in suppression of melatonin.
Low in blue spike removes suppression of melatonin needed for sleep.

Higher spike in red and yellow provides for warmer color.

Pre-sleep spectrum is intended to remove as much melatonin suppression as possible to prepare the crew for sleep.
Phase shift spectrum is intended to suppress melatonin, increase alertness. Used when circadian rhythm needs be phased shifted.

High spike in blue intended to suppress melatonin and increase alertness.

Low in red and yellow to amplify blue light effects.

Phase shift spectrum is intended to suppress melatonin, increase alertness. Used when circadian rhythm needs be phased shifted.
Basic Design View - Front

- Indicators
- Controls
- Diffuser
- Bezel
- Mounting Screws
- Faceplate
Basic Design View - Rear

- Power Connector J1
- Faceplate Assembly (Ground Bond)
- Chassis Assembly
- Power Interface Assembly
- Remote Control Connector J2
For all Modes
Hold buttons down to

Make Brighter

Make Dimmer

For all Modes
Press button to

Change mode

Turn on/off

New General Illumination

New Pre-Sleep

New Phase Shift
Examples for general

Indicator light turns green at maximum brightness

Indicator light turns blue at minimum brightness
Defaults and Maximum Brightness Settings
Defaults occur on power up. All modes are dimmable to 35% max.

General (neutral)
Default: 210 candela
Maximum: 340 candela
Minimum: 119 candela

Pre-Sleep (warm)
Default: 90 candela
Maximum: 130 candela
Minimum: 46 candela

Phase-Shift (cool)
Default: 420 candela
Maximum: 420 candela
Minimum: 147 candela

*In General Mode the SSLA output is approx. 25% more than the GLA.
**In General Mode the SSLA power consumption is approx. 20% less than the GLA.
Model Estimation of U.S. Lab Module Illumination @ .762 m (30 inches) (41000 requirements)
ISS module distributions for SSLA
Total 85 + 15 spares
General Luminaire Assemblies (GLA)  
Solid State Light Assemblies (SSLA)

Node 2 with 10 Lights
GLA at maximum brightness (170 cd) compared to SSLA at default brightness (210 cd General Mode).

Note:
SSLA was designed to maintenance free with a nominal design life of 40,000 hours with much more extended life expected when operating light at less than maximum power (the default for general mode is 60% of max).
Acknowledgments

Shawn Armstrong  NASA JSC
Alexandra Whitmire  Wyle Labs
Dr. George Brainard  Thomas Jefferson University
Jonathon Dory  NASA JSC
Toni Clark  Wyle Labs

And many more
The End