APPENDIX B

ALI SOFTWARE COMMANDS

# B.1 List of Commands for ALI Software

Following is a list of the commands that can be used in the ALI software for operational control during flight through the ground based communication program. A complete list will be presented then a description of each function will follow and are all case sensitive.

* EnableScience
* DisableScience
* EnableRF
* DisableRF
* EnableAutoSendStats
* DisableAutoSendStats
* SetScienceMode
* ReloadConfig
* LdCusCnf
* LdCusExp
* GetFile
* EndCurrentScienceCycle
* SetExposureScaleFactor
* UpdateExposureTimeCurve
* EnableCheckRfTemps
* DisableCheckRfTemps
* ResetHousekeeping
* DumpConfig
* SetBitsPerSecond
* EnableAutomation
* DisableAutomation
* SetAutomationTimeout
* EnableGps
* DisableGps
* EnablePulse
* DisablePulse

## B.1.1 EnableScience

Full Command: EnableScience

This command enables science data acquisition and enables the RF driver. If the current mode is invalid the systems reports the error to the user. By default science mode data acquisition is disabled and must be enabled.

## B.1.2 DisableScience

Full Command: DisableScience

This command disables science data acquisition at the end of the current science mode cycle. This mode does not disable the RF driver. The current mode will not end if the RF driver is currently disabled as disabling the RF driver only pauses the cycle. By default science data acquisition is disabled.

## B.1.3 EnableRF

Full Command: EnableRF

Turns on the RF driver by enabling the relay that controls the power to the device. Heavy power draw and by default is disabled.

## B.1.4 DisableRF

Full Command: DisbaleRF

Disable the RF driver during science mode accusation. This only pauses the science acquisition cycle mode and will continue once the driver is enabled again. By default the RF driver is disabled due to the high power draw.

## B.1.5 EnableAutoSendStats

Full Command: EnableAutoSendStats

Enables the sending of statistics for each image taken and include five vertical columns of measured data from the image, what percentage of the CCD well is full as well as exposure time length, time taken, location, RF power, and wavelength. By default this is enabled.

## B.1.6 DisableAutoSendStats

Full Command: DisableAutoSendStats

Disables the sending of statistics for each image taken. By default enabled.

## B.1.7 SetScienceMode

Full Command: SetScienceMode scienceMode,exposureMode

Parameter: scienceMode is a numerical value of the science mode to be run.

Parameter: exposureMode is a numerical value of the science mode to be run.

Allows the user to change science mode and exposure modes that ALI is preforming. The science mode is a predetermined cycle of images to perform a specific scientific goal and a table containing all of the modes is listed Table B-1 and a complete description of each cycle is presenting in section B.2. The exposure mode is a predetermined exposure time length to be used for each wavelength and a table containing all of the modes is listed Table B-6 and a complete description of each mode is presenting in section B-3. The next mode will be loaded once the current mode is complete. By default the program is set in Invalid Mode.

## B.1.8 ReloadConfig

Full Command: ReloadConfig

Upon completion of the current science cycle the science mode cycle will be reload from the configuration files.

## B.1.9 LdCusCnf

Full Command: LdCusCnf IsOneExp,NumExp,wavelegth,RFPower…

Parameter: IsOneExp is either a 0 or a 1. A 0 represents each exposure will have a different exposure time where a 1 represents that the exposure time used for the first image will be the same for all images.

Parameter: NumExp is the number of images in the custom science mode.

Parameter: wavelength,RFPower… is a pair of information for each image in the cycle as defined by NumExp consisting of a wavelength in nanometers and a RF power ranging from 0 to 1.

Uploads values for a custom science mode. The first value is whether a constant or varying exposure time is to be used for the cycle followed by the number of exposures. The for each exposure a pair of values that is supplied that consists of a wavelength in nanometers and RF Power. There is no check on the command apart from the right number of inputs. User must verify that the wavelength range is in between 600 and 1000 nm and the RF power is between 0 and 1.

## B.1.10 LdCusExp

Full Command: LdCusExp numTimes,time…

Parameter: numTime is the number of exposure times to be entered.

Parameter: time… is a series of times in seconds separated by commas to match the number of exposure times loaded into the custom mode.

Uploads values for a custom exposure time series. The first value is the number of exposures time followed by a series of time in seconds. If custom exposure time is used the number of exposures must match the number of exposure times or an error is sent to the user.

## B.1.11 GetFile

Full Command: GetFile filename

Parameter: filename is the image file to be downloaded from ALI with the full path.

Send a filename into the queue to be downloaded from ALI if the filename exsists. This entered file is added to the top of the queue.

## B.1.12 EndCurrentScienceCycle

Full Command: EndCurrentScienceCycle

Ends the current science operation mode immediately.

## B.1.13 SetExposureScaleFactor

Full Command: SetExposureScaleFactor scaleFactor

Parameter: scaleFactor is a number greater zero that scales the default calibrated exposure time curve seen in Table 3-6.

Sets a scaling factor for the exposure times. Value must be greater than zero or an error is returned. Default is 1.0.

## B.1.14 UpdateExposureTimeCurve

Full Command: UpdateExposureTimeCurve time…

Parameter: time… is a series of 13 times separated by commas with minimum values of 0.05 seconds and a maximum of 60 seconds. The 13 values correspond to exposure time for wavelengths from 650-950 nm in 25 nm intervals.

This function changes the default values in the calibrated exposure time curve. Default values can be seen in Table 3-6.

## B.1.15 EnableCheckRfTemps

Full Command: EnableCheckRfTemps

Enables a check to verify that the RF driver is not operating outside its rated temperature range. At 0 degrees Celsius the RF driver is powered on and at 50 degrees it is powered off. By default the check is enabled.

## B.1.16 DisableCheckRfTemps

Full Command: DisableCheckRfTemps

Disables the temperature check for the RF driver. By default the check is enabled and it is not recommenced unless an issue with the temperature sensors arises.

## B.1.17 ResetHousekeeping

Full Command: ResetHouseKeeping

Resets the housekeeping module to reacquire the voltage and temperature sensors. To only be used if there is a problem with the housekeeping module.

## B.1.18 DumpConfig

Full Command: DumpConfig

Prints the current configuration loaded into the science module. Used for debugging purposes.

## B.1.19 SetBitsPerSecond

Full Command: SetBitsPerSecond bitsPerSecond

Parameter: bitsPerSecond is the value to change the download speed to during operation in bits per second.

Changes the bitrate limit for the ALI operation program. Minimum value is 32000 bits per second and the default is 50000 bits for second.

## B.1.20 EnableAutomation

Full Command: EnableAutomation

Enables the automatic timeout process in case of a loss of communication during the launch. Enabled by default and after 90 minutes puts the system in aerosol mode.

## B.1.21 DisableAutomation

Full Command: DisableAutomation

Stops the process that automatically starts ALI in an aerosol mode science operation after 90 minutes. This process should be disabled if the user has control of the system at float altitude.

## B.1.22 SetAutomationTimeout

Full Command: SetAutomationTimeout time

Parameter: time is the new time in minutes to set the timeout value.

Changes the default timeout time to the time given in minutes. Default is 90, minimum is 5 and maximum is 240 minutes.

## B.1.23 EnableGps

Full Command: EnableGps

Starts the GPS process if it is not already started.

## B.1.24 DisableGps

Full Command: DisableGps

Stops the GPS process if it is not currently running.

## B.1.25 EnablePulse

Full Command: EnablePulse

Starts the pulse per second process if it is not already started.

## B.1.26 DisablePulse

Full Command: DisbalePulse

Stops the pulse per second process if it is not currently running.

# B.2 List of ALI Science Modes

The following section will give a brief description of each of the programmed science operational modes that exist on the ALI platform. A complete Table of the modes can be seen in Table B-.

**Table B-1:** ALI operational science modes.

|  |  |
| --- | --- |
| Mode Number | Mode Name |
| 0 | Invalid Mode |
| 1 | Calibration Mode |
| 2 | Aerosol Mode |
| 3 | H2O Mode |
| 4 | O2 Mode |
| 5 | Custom Mode |
| 6 | Aerosol Constant Exposure Time Mode |

## B.2.1 Invalid Mode

This mode is a nonexistent mode that has no operational function and will not allow the science module to operate. No images in the mode.

Mode Number: 0

Number of Images: N/A

## B.2.2 Calibration Mode

This mode runs with the shutter opened and the AOTF off. The scaling factor does not work on this function and the values are hard coded into the system. This mode does not use any wavelength values and the RF power is set at 0.

Mode: 1

Number of Images: 8

**Table B-2:** ALI calibration science mode specifications.

|  |  |  |  |
| --- | --- | --- | --- |
| Image Number | Exposure Time (s) | Image Number | Exposure Time (s) |
| 1 | 0.05 | 5 | 2.00 |
| 2 | 0.10 | 6 | 3.00 |
| 3 | 0.50 | 7 | 5.00 |
| 4 | 1.00 | 8 | 10.00 |

## B.2.3 Aerosol Mode

This mode runs with the standard aerosol mode. An AOTF off mode is taken between each exposure Custom exposure time can be used. Scale factor can be used. Exposure time based of the standard calibration curve which can be seen in Table 3-6.

Mode Number: 2

Number of Images: 26

**Table B-3:** ALI aerosol science mode specifications.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Image Number | Wavelength (nm) | RF Power | Image Number | Wavelength (nm) | RF Power |
| 1 | 650 | 0.0 | 14 | 800 | 1.0 |
| 2 | 650 | 1.0 | 15 | 825 | 0.0 |
| 3 | 675 | 0.0 | 16 | 825 | 1.0 |
| 4 | 675 | 1.0 | 17 | 850 | 0.0 |
| 5 | 700 | 0.0 | 18 | 850 | 1.0 |
| 6 | 700 | 1.0 | 19 | 875 | 0.0 |
| 7 | 725 | 0.0 | 20 | 875 | 1.0 |
| 8 | 725 | 1.0 | 21 | 900 | 0.0 |
| 9 | 750 | 0.0 | 22 | 900 | 1.0 |
| 10 | 750 | 0.9 | 23 | 925 | 0.0 |
| 11 | 775 | 0.0 | 24 | 925 | 1.0 |
| 12 | 775 | 0.9 | 25 | 950 | 0.0 |
| 13 | 800 | 0.0 | 26 | 950 | 1.0 |

## B.2.4 H2O Mode

This mode is used to measure water vapour lines. An AOTF off imae is taken at the start and end of each cycle. Custom exposure times can be used. A scale factor can be used. Exposure times are based off of the standard calibration curve for the first wavelength of the cycle and is constant for every image.

Mode Number: 3

Number of Images: 28

**Table B-4:** ALI H2O science mode specifications.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Image Number | Wavelength (nm) | RF Power | Image Number | Wavelength (nm) | RF Power |
| 1 | 920 | 0.0 | 15 | 946 | 1.0 |
| 2 | 920 | 1.0 | 16 | 948 | 1.0 |
| 3 | 922 | 1.0 | 17 | 950 | 1.0 |
| 4 | 924 | 1.0 | 18 | 952 | 1.0 |
| 5 | 926 | 1.0 | 19 | 954 | 1.0 |
| 6 | 928 | 1.0 | 20 | 956 | 1.0 |
| 7 | 930 | 1.0 | 21 | 958 | 1.0 |
| 8 | 932 | 1.0 | 22 | 960 | 1.0 |
| 9 | 934 | 1.0 | 23 | 962 | 1.0 |
| 10 | 936 | 1.0 | 24 | 964 | 1.0 |
| 11 | 938 | 1.0 | 25 | 966 | 1.0 |
| 12 | 940 | 1.0 | 26 | 968 | 1.0 |
| 13 | 942 | 1.0 | 27 | 970 | 1.0 |
| 14 | 944 | 1.0 | 28 | 970 | 0.0 |

## B.2.5 O2 Mode

This mode runs is used to measure O2 lines. An AOTF off image is taken at the start and end of each cycle. Custom exposure time can be used. A scale factor can be used. Exposure times are based off of the standard calibration curve for the first wavelength of the cycle and is constant for every image.

Mode Number: 4

Number of Images: 20

**Table B-5:** ALI O2 science mode specifications.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Image Number | Wavelength (nm) | RF Power | Image Number | Wavelength (nm) | RF Power |
| 1 | 755 | 0.0 | 11 | 764 | 1.0 |
| 2 | 755 | 1.0 | 12 | 765 | 1.0 |
| 3 | 756 | 1.0 | 13 | 766 | 1.0 |
| 4 | 757 | 1.0 | 14 | 767 | 1.0 |
| 5 | 758 | 1.0 | 15 | 768 | 1.0 |
| 6 | 759 | 1.0 | 16 | 769 | 1.0 |
| 7 | 760 | 1.0 | 17 | 770 | 1.0 |
| 8 | 761 | 1.0 | 18 | 771 | 1.0 |
| 9 | 762 | 1.0 | 19 | 772 | 1.0 |
| 10 | 763 | 1.0 | 20 | 772 | 0.0 |

## B.2.6 Custom Mode

This mode runs lets the user upload a configuration to an extra configuration file on the ALI platform. The command is sent up via the LdCusCnf command. Details can be located in section B.1.9.

Mode Number: 5

Number of Images: N/A

## B.2.7 Aerosol Constant Exposure Time Mode

Same as the aerosol science mode (section B.2.3) except the exposure time has been set to two seconds for all exposures. The scaling factor is applied to this mode. A table of the specifications can be seen in Table B-3.

Mode Number: 6

Number of Images: 26

# B.3 List of ALI Exposure Modes

ALI had two usable exposure modes during the campaign a calibrated mode and a custom mode which can be configured by the user. An automatic exposure mode was planned but due to time constraints was never implemented. A brief description of the modes will follow.

**Table B-6:** ALI operational exposure time modes.

|  |  |
| --- | --- |
| Mode Number | Mode Name |
| 0 | Invalid Mode |
| 1 | Calibrated Exposure Mode |
| 2 | Automatic Exposure Mode (*Not Implemented*) |
| 3 | Custom Exposure Mode |

## B.3.1 Invalid Mode

This mode is a nonexistent mode that has no operational function and will not allow the science module to operate. No exposure times associated with this mode.

Mode Number: 0

## B.3.2 Calibrated Exposure Mode

Using the method outlined in section 3.6.1, a table of calibrated exposure times were determined for a stratospheric balloon geometry. Table 3-6 contains the calibrated exposure times. For any wavelength requested that is between two of the calibrated wavelength the exposure time is determined from is a linear interpolation to determine the two wavelengths exposure times. For wavelengths less than 650 nm the exposure time for 650 is used, and similarly for wavelengths greater than 950 nm.

Mode Number: 1

## B.3.3 Custom Exposure Mode

This mode runs lets the user upload a series of exposure times on the ALI platform to be used instead of the calibrated exposure mode. The command is sent up via the LdCusExp command. Details can be located in section B.1.10.

Mode Number: 3