4 Acceleration Measurement System Descriptions: Increment-3

One of the major goals of ISS is to provide a quiescent reduced gravity environment to perform fundamental scientific research. However, small disturbances aboard the Space Station impact the overall environment in which experiments are being performed. Such small disturbances need to be measured in order to assess their potential impact on the experiments. Two accelerometer systems developed by NASA's GRC in Cleveland, Ohio, are being used aboard the station to acquire such measurements. These two systems were flown to the ISS on April 19, 2001 aboard the space shuttle flight STS-100.

4.1 Microgravity Acceleration Measurement System (MAMS)

MAMS measures acceleration caused by aerodynamic drag, vehicle rotations, and vents of air and water. MAMS consists of two sensors. MAMS OSS, a low frequency sensor (up to 1 Hz), is used to characterize the quasi-steady environment for payloads and the vehicle. MAMS HiRAP [11] is used to characterize the ISS vibratory environment up to 100 Hz. For Increment-3, MAMS was located in a double middeck locker, in the US Laboratory Module (Destiny) in the EXpedite the PRocessing of Experiments to the Space Station (EXPRESS) Rack 1.

4.2 MAMS Coordinate Systems

MAMS was located in middeck lockers 3 and 4 of EXPRESS Rack 1, in overhead bay 2 of the US Laboratory Module (LAB1O2). The origin of the OSS coordinate system is located at the center of gravity of the OSS proof mass. Table 4-1 gives the orientation and location of the OSS and HiRAP coordinate systems with respect to Space Station Analysis coordinate system.

TABLE 4-1 MAMS SENSOR COORDINATE SYSTEM

MAMS Sensor	Location (inches)			Orientation (degrees)			Unit Vector in Analysis Coordinates			
	X_A	Y_A	Z_A	Roll	Pitch	Yaw	Axes	X_A	Y_A	Z_A
OSS	135.28	-10.68	132.12	90	0	0	X_{OSS}	1	0	0
							Y_{OSS}	0	0	1
							Z_{OSS}	0	-1	0
HiRAP	138.68	-16.18	142.35	180	0	0	X_H	1	0	0
							Y_H	0	-1	0
							Z_H	0	0	-1

4.3 Space Acceleration Measurement System (SAMS)

SAMS measures accelerations caused by vehicle, crew, and experiment disturbances. SAMS measures the vibratory/transient accelerations, which occur in the frequency range of 0.01 to 400 Hz. For Increment-3, there were five SAMS sensor heads located in the EXPRESS

Racks 1 and 2. The sensors measure the accelerations electronically and transmit the data to the Interim Control Unit (ICU) located in the EXPRESS Rack drawer. Data is collected from all the sensors and downlinked to the Telescience Support Center (TSC) at GRC. The PIMS project processes, and displays the data on the PIMS Web site for easy access by the microgravity scientific community at:

http://pims.grc.nasa.gov.

4.4 SAMS Coordinate Systems

During Increment-3, five SAMS Sensor Enclosure (SE) heads were active: 121f02 through121f06. Each sensor head has a defined coordinate system whose location and orientation is with respect to the Space Station Analysis Coordinate System. The origin is defined as the triaxial center point of the three accelerometers that comprise the head.

SAMS SE 121f02 was mounted in the SAMS ISIS drawer 1 in EXPRESS Rack 1. SAMS SE heads 121f03, 121f04 and 121f05 were installed in support of Active Ract Isolation System ISS Characterization Experiment (ARIS-ICE) activities. Head 121f03 was mounted on the lower Z Panel assembly below EXPRESS Rack 2, head 121f04 was mounted on the lower Z Panel assembly below EXPRESS Rack 1, and head 121f05 was mounted on a bracket around the upper Z Panel light assembly of EXPRESS Rack 2. SAMS SE 121f06 was mounted on the front panel of the EXPeriment of Physics of Colloids in Space (EXPPCS) test section on EXPRESS Rack 2. Table 4-2 summarizes the SAMS SE coordinate systems.

TABLE 4-2 SAMS SE COORDINATE SYSTEMS

Sensor	Location (inches)			Orientation (degrees)			Unit Vector in Analysis Coordinates			
	X_A	Y_A	Z_A	Roll	Pitch	Yaw	Axes	X_A	Y_A	Z_A
121f02	128.73	-23.53	144.15	-90	0	-90	X_{F02}	0	-1	0
							Y_{F02}	0	0	-1
							Z_{F02}	1	0	0
121f03	191.54	-40.54	135.25	0	30	-90	X_{F03}	0	-.866	-.500
							Y_{F03}	1	0	0
							Z_{F03}	0	-.5	.866
121f04	149.54	-40.54	135.25	0	30	-90	X_{F04}	0	-.866	-.500
							Y_{F04}	1	0	0
							Z_{F04}	0	-.5	.866
121f05	185.17	38.55	149.93	90	0	90	X_{F05}	0	1	0
							Y_{F05}	0	0	1
							Z_{F05}	1	0	0
121f06	179.90	-6.44	145.55	180	90	0	X_{F06}	0	0	-1
							Y_{F06}	0	-1	0
							Z_{F06}	-1	0	0