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NASA Promotion



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NASA's Anthropometry and Biomechanics Lab

NASA's Johnson Space Center houses the Anthropometry and Biomechanics Lab (ABL), a unique facility dedicated to the study of human body measurements and movement mechanics. The lab plays a crucial role in designing protective space gear for astronauts, taking into account the limits of skeletal muscle strength, power, and endurance.

Data Collection

The ABL collects data in various settings, including the controlled one-gravity setting of the lab, the weightless environment training facility, the precision air bearing floor, and the three-dimensional zero-gravity created aboard the KC-135 research aircraft. This data informs the design of spacesuits for extra-vehicular activity, spacecraft interiors, and future space stations.

Suit Design and Testing

The ABL has significantly contributed to the design process for NASA's next-generation space station EVA suit. Both the Mach 3 and the AX5 prototype space station suits have undergone extensive testing by the ABL. The lab is also involved in the development of lunar and Mars space suits.

Biomechanics Data Acquisition System

The ABL uses an integrated biomechanics data acquisition system, consisting of dynamometry, electromyography, force plates, and 3D motion mechanics. A load-cell instrumented treadmill measures impact forces on the skeleton during locomotion, providing valuable data for suit design. Electromyography monitors muscle activity, while force plates register reaction forces and moments exerted around the plate.

Ariel Performance Analysis System

One of the recent additions to the ABL is the Ariel performance analysis system. This computer system works with a video player and monitor to digitize body joints from video recordings, helping determine the reach distance of the subject.

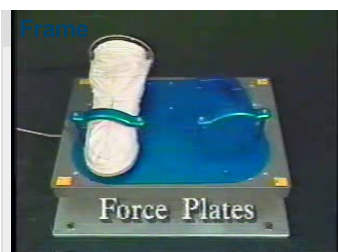
For more information, visit www.beadaholique.com.

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Audio transcription

Frame	#	Time	Spoken text
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Frame	#	Time	Spoken text
	0.	00:00:00	At NASA's Johnson Space Center, the anthropometry and biomechanics lab investigates many of
	1.	00:00:08	the biomechanics issues that go into the human factors design of protective space gear for
	2.	00:00:13	astronauts.
	3.	00:00:15	The lab's name clearly describes its function.
	4.	00:00:19	Anthropometry is the measurement and classification of the human body.
	5.	00:00:24	Biomechanics is the study of how living creatures move the way they do.
	6.	00:00:28	When designing equipment for astronauts to use in space, the limits of skeletal muscle
	7.	00:00:33	strength, power, and endurance must be understood in order to plan realistic EVA performance.
	8.	00:00:41	Data concerning these areas is collected in several different settings by the biomechanics
	9.	00:00:45	lab.
	10.	00:00:47	In the controlled one-gravity setting of the ABL itself, in the neutral buoyancy of the
	11.	00:00:53	weightless environment training facility, on the two-dimensional zero-gravity of the
	12.	00:00:58	precision air bearing floor, and, in the actual three-dimensional zero-gravity, created
	13.	00:01:04	aboard the KC-135 research aircraft.
	14.	00:01:09	This data is then fed back to the engineers who designed spacesuits for extra-vehicular
	15.	00:01:14	activity, also the living area inside a spacecraft, and the soon-to-be-built space station freedom.
	16.	00:01:22	In addition to collecting anthropometry measurements for all astronaut candidates, the ABL has
	17.	00:01:27	also played a major role in the design process for NASA's next-generation space station
	18.	00:01:32	EVA suit.
	19.	00:01:34	Both the Mach 3 and the AX5 prototype space station suits have undergone extensive testing
	20.	00:01:40	by the ABL.
	21.	00:01:42	The lab is also involved in the development of a lunar suit and the Mars space suit.
	22.	00:01:49	To gather this information, the ABL uses an integrated biomechanics data acquisition system.
	23.	00:01:56	This system consists of four components, dynamometry, electromyography, force plates,
	24.	00:02:03	and 3D motion mechanics.
	25.	00:02:05	A load-cell instrumented treadmill is used to measure the impact forces acting on the
	26.	00:02:10	body's skeleton during locomotion.
	27.	00:02:13	It produces information concerning lower torso mobility limits, which can be incorporated
	28.	00:02:19	into designs for a Mars lunar suit.
	29.	00:02:22	The treadmill can be used in both the ABL and the KC-135.
	30.	00:02:28	Moving about in a pressure suit is hard work, so muscle endurance is important.
	31.	00:02:34	Through electromyography, an electrode can be used to monitor the electrical activity
	32.	00:02:39	of a specific muscle, such as the timing and sequence of contractions.
	33.	00:02:43	With this information, researchers can determine how hard a muscle was working under various
	34.	00:02:48	conditions.
	35.	00:02:50	Force plates are another method of testing used at the ABL.



#	Time	Spoken text
36.	00:02:54	<i>They register the X, Y, and Z reaction forces and moments that are exerted around the plate.</i>
37.	00:03:02	<i>This helps determine how factors such as force, vibration, sound, and material strengths</i>
38.	00:03:08	<i>affect design.</i>
39.	00:03:10	<i>All of this is important when determining how strong or how weak a certain piece of equipment</i>



40.	00:03:15	<i>needs to be.</i>
41.	00:03:17	<i>One of the more recent additions to the ABL is the Ariel performance analysis system.</i>
42.	00:03:23	<i>The Ariel is actually a computer that works in conjunction with a video player and monitor.</i>
43.	00:03:29	<i>Through frame-by-frame analysis, body joints are manually digitized from video recordings.</i>
44.	00:03:35	<i>The points can then be graphed and analyzed or used to create an animated figure.</i>



45.	00:03:42	<i>This helps determine how far the subject can stretch his or her arms.</i>
46.	00:03:46	<i>To call this, the distance reach on below.</i>
47.	00:03:50	<i>The anthropometry and biomechanics lab is the only facility of its kind.</i>
48.	00:04:46	<i>For more information, visit www.beadaholique.com to purchase beading supplies and to get design ideas!</i>

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