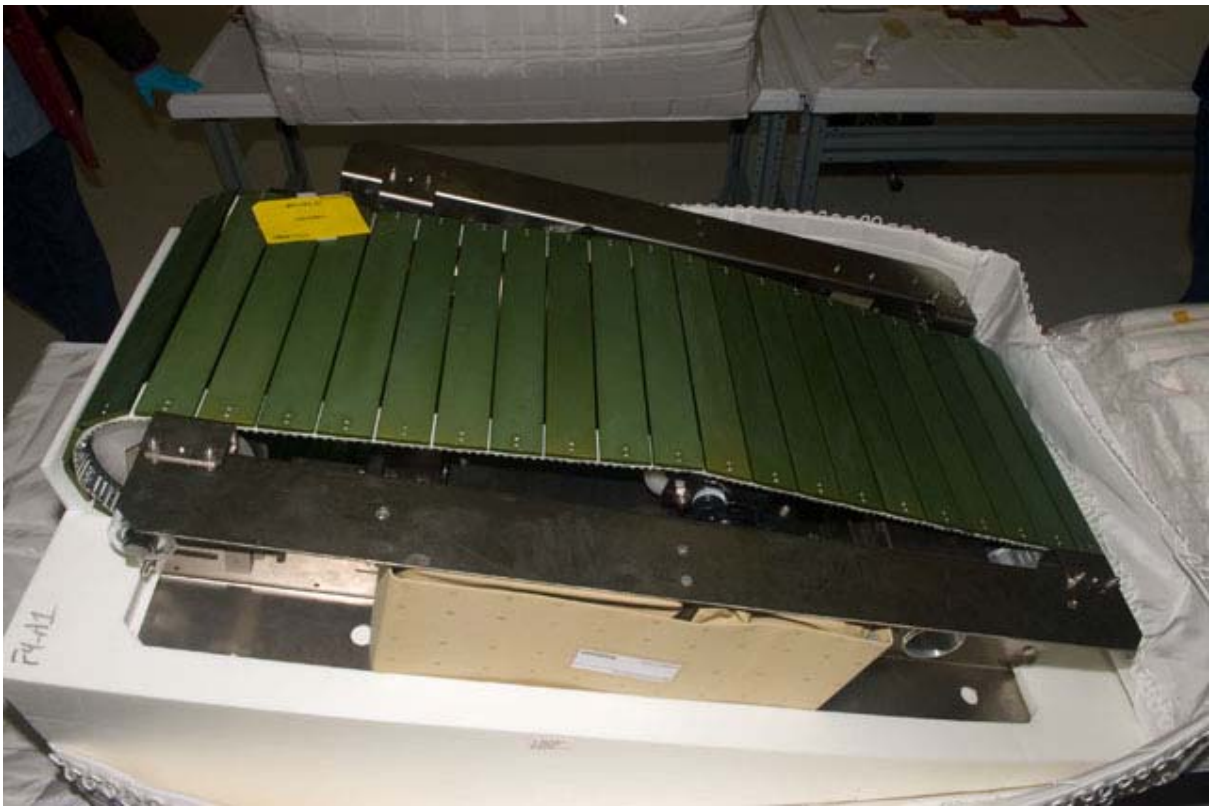
COMBINED OPERATIONAL LOAD BEARING EXTERNAL RESISTANCE TREADMILL (COLBERT)



The Combined Operational Load Bearing External Resistance Treadmill (COLBERT) is packed and prepared for stowage aboard Discovery for its transport to the International Space Station.

Training for future exploration missions is a key goal for the International Space Station Program, and a new treadmill launching on STS-128 will help doctors determine just how important "training" is to humans on long-space journeys.

That's training as in exercise, and treadmill as in COLBERT, or the Combined Operational Load Bearing External Resistance Treadmill, so named for comedian Stephen Colbert of Comedy Central's "The Colbert Report."

The COLBERT will be the second treadmill on the space station, adding to a complement of six different exercise devices already in orbit that range from stationary bicycles to resistive exercise devices. First and foremost, the new treadmill is a critical countermeasure device that will be used to keep the international crew healthy while in orbit, and prepare them for return to Earth.

In addition, the COLBERT will feature data collection devices that will allow doctors and scientists to evaluate how effective the treadmill exercise is in reducing the amount of bone and muscle density loss due to life without gravity. Data on treadmill speed, session duration and body load of each crew member's exercise

session will help scientists understand spaceflight-induced physiological changes in the cardiovascular, muscle, bone and sensorimotor systems.

The first experiment to use the COLBERT will be the Functional Task Test (FTT), a multidisciplinary study designed to identify the key underlying physiological factors that contribute to performance of functional tests that are representative of critical mission tasks for lunar and Mars operations. FTT's principal investigator is Jacob Bloomberg of NASA's Johnson Space Center (JSC), Houston.

This is not the first treadmill on the station. Station residents currently are using the Treadmill with Vibration Isolation System (TVIS) that's recessed in the floor of the Zvezda service module. Expedition 20 flight engineers Mike Barratt and Koichi Wakata just performed a complete overhaul of that treadmill to extend its life. Both treadmills will continue to be used, which will nearly double the availability of this critical work-out device for six-person crews.

While the purpose and general functionality of TVIS and COLBERT will be the same, there are a couple of significant differences.

First, the actual treadmill for COLBERT was purchased from Woodway USA, Waukesha, Wis., while TVIS was developed in-house at JSC. The COLBERT and supporting subsystems (power, cooling, etc.) will be housed in an International Standard Payloads Rack (ISPR). The entire assembly will be housed initially in the station's Harmony module, then be moved to the Tranquility module after it is launched in early 2010. Tranquility is a pressurized module that will provide room for many of the space station's life support systems. Attached to the node is a cupola, which is a unique workstation with six windows on the sides and one on top.

Second, the two use different methods to keep the vibrations generated by runners from shaking the sensitive microgravity experiments on the station. TVIS uses an active system of throw masses that sense running forces and "throw" a counterweight in the opposite direction to counteract the vibrations. TVIS also uses some light tethers and a gyroscope. COLBERT was designed to be heavy, so that its inertial mass will be the primary method for dampening the vibrations. The total weight of the COLBERT rack is 2,200 pounds fully configured in orbit. Launch weight is around 1,600 pounds. Individual treadmill weighs about 300 pounds. The entire rack will have a modified Passive Rack Isolation System (PaRIS) that uses two-stage isolators, or springs, to dampen different vibration frequencies.

The main reasons for the different approach were to simplify the system, making it easier and less costly to maintain. The simpler design also is expected to result in higher reliability, making the new treadmill consistently available to the crew, which must work out daily to counteract the loss of bone and muscle density that is a side effect of long-duration stays in orbit. If all goes as expected, the COLBERT will have a five-year service life.

There are a number of COLBERT and TVIS similarities. Both have running surfaces made of aluminum. The COLBERT treadmill surface uses the exact same aluminum as a commercial treadmill, but a rubber coating is stripped off the top of the treads and that aluminum is anodized to provide surface roughness and protection.

Both treadmills meet the payload requirements for vibration isolation. COLBERT and TVIS are very close in most frequencies, but each is able to dampen some frequencies better than the other.

COLBERT's maximum speed is 12.4 miles an hour, but don't expect crew members to run that fast because 12.4 miles an hour is faster than the Olympic 100-meter race record. An average person runs 7- to- 8 miles an hour, and most crew members will run about 4- to- 8 miles an hour.

Another improvement is that COLBERT is designed so that ground experts tracking crew health in orbit can create individual exercise prescriptions and uplink them to the crew as a profile. COLBERT will use the same control interface as that used for the Advanced Resistive Exercise Device (ARED) so that crew members won't have to learn a new interface. The interface is modeled on commercial treadmills and looks nearly identical to what you'd find in many gyms on Earth. The standard rack connection device, the same seat tracks used in Boeing airliners, will provide locations where the crew can mount devices such as laptop computers so they can entertain themselves while exercising.

Each crew member is required to work out a total of two and a half hours a day, about an hour of that on the treadmill. Astronauts are expected to burn between 250 and 500 calories while working out on COLBERT, which has instrumented load cells and three-axis accelerometers that can measure the foot force of running. Ground experts will be able to use this information to determine how well they are being conditioned or losing their deconditioning, and adjust exercise prescriptions accordingly.

Setting up for an exercise session on COLBERT should be fairly simple. The first runner of the day will turn it on by flipping the rack power switch. After waiting a couple minutes for all systems to activate, they'll position the control interface to a location comfortable for them. They'll connect bungee cords to provide a load that will generate the foot force necessary to give the astronaut's bones and muscles a workout in the absence of gravity. They'll put on the harness that connects them to the bungees, set the desired load and verify that they agree with their prescription. Then, they'll log into the system, pick a profile, hit start and go. In the future, a new load system being developed by the European Space Agency will provide highly accurate, continuous force that's closer to a full one-gravity body weight.

The two treadmills provide side benefits for the entire crew, because as humans exercise they respire (breathe) and perspire (sweat) and that moisture is reclaimed by the station's systems that recycle moisture from the station's atmosphere.

NASA chose the acronym COLBERT after the television comedian's campaign for write-in votes to name the next module after himself. NASA chose to name the module Tranquility instead, in honor of the 40th anniversary of the first Apollo landing on the moon. Expedition 14 and 15 astronaut Suni Williams made the announcement on "The Colbert Report" two years after running the Boston Marathon in space.

The COLBERT rack, treadmill and support hardware will launch in the Leonardo Multi-purpose Logistics Module and be transferred to the station on flight day 5. The new workout machine will be set up and used after the shuttle Discovery departs.