MIT Course 16.831/12.431 *Description* (Spring, 2012)

Space Systems Development (16.831J / 12.431J)
Tuesday, Thursday 1 -5 PM, MIT Bldg. 35 Room 225 OR at Harvard/CfA (TBA)
Prof. Dave Miller, Prof. Kerri Cahoy, Prof. Sara Seager (MIT); with Prof. Josh Grindlay (Harvard)

Join one of our two student-designed spacecraft projects and learn how to build a real space system! We will refine and realize sub-system designs and fabricate full-scale prototypes. Sub-systems include payload science, power, communications, avionics, attitude determination and control, and thermal systems, and they are integrated into a space vehicle and tested. We validate sub-system performance experimentally in the lab, and compare our results with physical models of performance to meet our design goals. Leadership, teamwork, and communication skills are honed through written reports and oral presentations.

This semester's projects involve efforts to learn about asteroids and how to protect Earth from them, and to learn how we can protect valuable spacecraft that orbit the Earth from high-energy particles that are trapped by the Earth's magnetic field. Students will choose to work on one of the two following ongoing projects (Harvard students will work on REXIS, together with MIT students):

REXIS (Regolith X-ray Imaging Spectrometer): Collaborative effort between MIT and **Harvard** for a *student-built* instrument on the recently approved (May, 2011) NASA mission OSIRIS-REx to visit and map the elemental abundance of the near-Earth asteroid 1999 RQ36 (which might impact the Earth in 2170!). REXIS performs X-ray imaging spectrometry using an array of CCDs (charged-coupled devices) to detect X-rays emitted in fluorescence spectral lines (O, Mg, Si, S, Fe, etc.) from the asteroid surface excited by incident X-rays from the Sun. REXIS is a unique opportunity to experience a *real* space flight program. The REXIS instrument will be delivered in 2015 in preparation for launch in late 2016. The spring 2012 semester program will prepare for the SDR (system design review) at NASA on April 24, 2012, as well as assemble in the lab the first engineering prototype of the REXIS X-ray telescope. Students will participate in requirements definition and flowdown and will finalize design and assembly for the functional engineering test unit, with followup opportunities for testing the unit this summer.

TERSat (Trapped Energetic Radiation Satellite): Be part of the MIT Satellite Team in the University Nanosatellite Competition (Nanosat-7). TERSat is a small 50 kg satellite that will pack an electromagnetic punch to knock harmful high-energy particles out of the inner Van Allen Radiation Belt and help protect satellites. TERSat will deploy a high-power pop-out antenna and use a Very Low Frequency (VLF) transmitter to radiate short 1 kW pulses, and use an onboard VLF receiver to measure how the charged particles (plasma) responds. Students will have the opportunity to present at the Nanosat-7 CDR on campus in April, and to represent TERSat at the Small Satellite conference at Utah State in the summer.