

C-TEC's Mission to Mars

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C-TEC's Mission to Mars was one of our first adventures in the virtual exploration of Mars, inspired by Eric Burgess's *Return to the Red Planet*, Kim Stanley Robinson's *Red Mars*, Ben Bova's *Mars*, and visits to NASA's Ames Research Center in Mountain View, California.

Here we present a slightly edited version of C-TEC's Mission to Mars. It has been 13 years since the article appeared in *The Computing Teacher*. Much ado about Mars has happened since then! As you read, remember that many of the nonfiction resources we used in 1993–1994 may be replaced by up-to-date resources that you can find elsewhere in Investigation Backpack #4.

The novels, Bova's *Mars* and Robinson's *Red Mars* are still A-OK.

Reality expands to fill the available fantasies. – Laran Stardrake

Mission to Mars

The Center for Technology, Environment, and Communication (C-TEC) is an alternative learning community at Piner High School in Santa Rosa, California. C-TEC can be very flexible in scheduling activities, investigations, and projects, as you will see in this tale of C-TEC's Mission to Mars.

November 9, 1993. C-TEC teachers James Gonzalez and Paul Davis and consultant Bob Albrecht spend the day at the Teacher Resource Center located at NASA's Ames Research Center, Moffett Field, California. We call in advance to describe our special interest (Mars), schedule time, and arrange to have videotape duplicators available for our use. Thanks to Virginia Zeitman, who runs the center wonderfully well, our visit is overwhelmingly successful. Virginia has stacks of relevant resources ready for our perusal, including several new videos that we gleefully copy. We gather so much of the right stuff that, on the way home, someone says, "Let's cancel all classes for a week or so and go to Mars."

November 10 - 24, 1993. To make it so, we have to sell the idea to seven other teachers and to student representatives who are part of C-TEC's common planning team. This takes about two weeks. (How that happened is a story too long to tell here.)

November 25 - 30, 1993. The common planning team decides that the investigation will be a mission to Mars to establish the first permanent community. C-TEC's 186 students, nine teachers, and a few others will be the settlers. Planning a community on Mars is about as interdisciplinary as you can get. Each teacher selects a major area of responsibility:

Paul Davis	Civil engineering / Colony site / Communications
Libby Donahue	Living conditions / Interior design of habitat
Don Feleay	Transportation (Earth to Mars, Mars shuttle, rovers, ...)
Neal Glasgow	Life Sciences / Physiology / Psychology / Growing food
James Gonzalez	Engineering / Marscraft / Space suits / Habitat design
Brigette Mansell-Berry	Recreation / Sports / Art / Music / Morale
Mary Lou McDonald	Mars Media Group (document entire investigation)
Patti Michiels	Spanish / Nutrition / Diet
Ted Milkoff	Government / Constitution / Bill of rights / Economics

All C-TEC classes will be cancelled and the Mission to Mars will be C-TEC's full-time job December 9 – 17, the last days of school in 1993. Students will be divided among the nine teachers and will work with their teachers, coaches, and mentors for the entire seven school days. Each teacher will have an appropriate mix of sophomores, juniors, and seniors. Smaller teams will be formed to work on specific tasks within each teacher's purview. Each team will include a junior or senior who might act as a team leader and peer mentor for sophomore team members. The investigation will have three major goals:

- Team-building. Teams will consist of mixed grades and students who had not before worked together, researching topics they find interesting and building a sense of community.
- Authenticity. Students will do real work for a common purpose in a manner much like the way similar work is done in the real world.
- Communication. Everything in this investigation is intertwined with everything else in this investigation. Communication among teams must be established early and maintained throughout the investigation. As it turned out, this was the most difficult goal to achieve.

All work is to be completed on December 16. Teams will run through their presentations that afternoon. During the morning of December 17, all teams will present their work in a science fair setting. That afternoon, there will be a party and C-TEC's end-of-year multimedia show.

December 2-8. The Mission to Mars is announced to all students. Each student requests 1st, 2nd, and 3rd choices for a general area of investigation and teacher / coach / mentor. Fortunately, the students themselves choose in a way that distributes them about equally among teachers, and almost every student gets her or his first or second choice.

December 9. Mission to Mars, Day 1. Each group meets, is briefed, splits into teams of four or five students, and generally gets organized. Much thrashing about! Each room appoints a communication liaison person. Liaison people meet each day in the Mars Media Center to exchange information. The 21-member Mars Media Team, armed with paper, pencils, audio tape recorders, still cameras, and video cameras, begins thorough coverage of every aspect of the Mission to Mars.

December 10. Real work begins. Teams settle down and begin researching their tasks. Today's highlight is the appearance of the first issue of the *Mars Mission Update*, a concise summary of the previous day's activities, published by the Mars Media Team. It is becoming apparent that communication among teams is essential to get this investigation done. Teams begin sending emissaries to collect needed information from other teams. The daily liaison meetings become more useful as a communication vehicle.

December 13. Something special today: a visitor from NASA. In the morning, Minot Parker, a NASA Aerospace Education Specialist, puts on a terrific show for all of C-TEC, then spends two hours on his feet answering questions from students relevant to C-TEC's Mission to Mars. Investigation work continues in the afternoon.

December 14. Space scientist and author Eric Burgess spends the day at C-TEC, wandering from room to room, answering questions, making suggestions, helping, inspiring, et cetera, et cetera. Eric is author of numerous books on space exploration, including *Return to the Red Planet*. Eric will return to C-TEC twice before the end of the mission.

December 15. Some teams are progressing toward completion of their tasks. Some teams have run into problems because of lack of communication with other teams. One team has set up a stress reduction room with original music and relaxing visuals. It is frequently visited on this day before work must be completed.

December 16. Panic! This is it, the day on which all work must be completed. The stress reduction room is overworked. Somehow, it happens. In the afternoon, teams begin rehearsing their presentations.

December 17. It's a carnival! The school library and two other large rooms bustle with activity. There are oral presentations, video presentations, computer animation presentations, original Mars music playing, posters, a Mars art show, very large format children's books about life on Mars written in Spanish. C-TEC students, teachers, and many visitors mill around, participating, enjoying, being boggled. **Mission accomplished!**

We don't have space to really describe C-TEC's Mission to Mars. We are reviewing hundreds of pages of student reports, kilometers of videotape, computer animations, et cetera, et cetera.

Table 1 displays resources C-TEC used in its Mission to Mars. The list is much larger. We continue adding to it as we find and review new books, videos, software, and other media.

Table 1 resources were A-OK in 1993, but many no longer exist. For up-to-date resources:

Go to www.curriki.org and search for 'mars'.
Go to www.pacifier.com/~octm/TOMT/InvBack.html.

Table 2 shows the addresses and phone numbers of addresses and phone numbers of sources of resources that appear in Table 1, including NASA Teacher Resource Centers. We encourage you to visit a Teacher Resource Center even if you are not especially interested in space science.

Table 2 is hopelessly out-of-date, so we omit it.
For information about NASA Educator Resource Centers, go to:

NASA - Educator Resource Center Network
http://education.nasa.gov/about/contacts/Educator_Resource_Center_Network.html

NASA – Educator Resource Centers by State
www.nasa.gov/audience/foreducators/k-4/contacts/ERCN_State_Listing.html

Figure 3 contains information about Earth and Mars. We collected this data from various sources, some of which differ slightly from one another. If you find errors, please tell us about them. We have updated the information in Table 3 by using data from the National Space Sciences Data Center.

Mars Fact Sheet (<http://nssdc.gsfc.nasa.gov/planetary/factsheet/marsfact.html>)

Want to try a mission to Mars? Begin by getting the map, *Explorer's Guide to Mars*, from the Planetary Society (<http://planetarysociety.stores.yahoo.net/planetary-store-505.html>), and read the novels, Ben Bova's *Mars* and Kim Stanley Robinson's *Red Mars*. Use the map to locate the places mentioned in the books. **Newer resources:**

The Case for Mars by Robert Zubrin explains step-by-step how we can use today's technology to send people to Mars.

First Landing by Robert Zubrin uses Zubrin's *Case for Mars* ideas in a fictional setting.

Want to learn about space history in a great way? Load *Buzz Aldrin's Race Into Space* into your computer. It's a computer simulation of the US versus USSR race to Earth's moon. Want to build a space station? Use *SPACE M+A+X*, a computer simulation of building a commercial space station. Can you do it within budget? **SPACE M+A+X is no longer available.**

Buzz Aldrin's Race into Space – Wikipedia
http://en.wikipedia.org/wiki/Buzz_Aldrin's_Race_into_Space

Table 1. C-TEC's Mission to Mars December 1993 – Media Resources

Media code M1: Book, Catalog, Map, Periodical, Software, Video
Media code M2: Fiction, Information, Simulation, Tutorial, **TG** – Teacher's Guide

Author	Title	Publisher	M1	M2	Subj
Boulder Center for Science & Policy	Case for Mars, The	Boulder Center for Science & Policy	B	I	Mars
Bova, Ben	Mars	Bantam Books	B	F	Mars
Bronner, F., Buzz Aldrin	Buzz Aldrin's Race Into Space	Interplay	S	S	space
Burgess, Eric	Return to the Red Planet	Columbia U Press	B	I	Mars
Collins, Michael	Mission to Mars	Grove Press	B	I	Mars
Gump, David P.	Space Enterprise	Praeger Publishers	B	I	space
Jones, J. & Anita Flynn	Mobile Robots	Peters, A.K. Ltd.	B	T	robots
Kastner, Bernice	Space Mathematics	NASA	B	T	math
Keller, T.L.	SPACE M+A+X	Final Frontier	S	S	space
McComb, Gordon	Robot Builder's Bonanza	Tab Books	B	T	robots
NASA	Eating and Sleeping in Space	NASA	V	I	space
NASA	Fourth Planet, The	NASA	V	I	Mars
NASA	Life on Mars	NASA	V	I	Mars
NASA	Mars: the Next Step	NASA	V	I	Mars
NASA	Mars Rover Return Mission	NASA	V	I	Mars
NASA	Space Exploration Initiative	NASA	V	I	Mars
NASA	Working in Space	NASA	V	I	space
Nicogossian, Arnauld	Space Physiology and Medicine	Lea & Febiger	B	I	life sci
Planetary Society	Explorer's Guide to Mars	Planetary Society	M	I	Mars
Quest Aerospace	Flying Model Rockets	Quest Aerospace	C	I	rockets
Robinson, Kim Stanley	Red Mars	Bantam Books	B	F	Mars
Stine, G. Harry	Handbook of Model Rocketry	Prentice Hall	B	T	rockets
Vogt, Gregory L.	Rockets	NASA	B	TG	rockets
Weigel, Elsie, Ed.	Educational Horizons	NASA	P	I	space

Table 3. C-TEC's Mission to Mars – Earth and Mars Data (Updated 2005-01-01)

Physical data from the National Space Sciences Data Center
 Mars Fact Sheet (<http://nssdc.gsfc.nasa.gov/planetary/factsheet/marsfact.html>)

Planet	Average distance from the Sun		Orbital period		Inclination	
	AU	km	Earth days	Earth years	axis to orbit	orbit to ecliptic
Earth	1.000	149.60E6	365.242	1.0000	23.45°	0.000
Mars	1.524	227.92E6	686.973	1.881	25.19°	1.850

	Diameter		Length of solar day		Mass		Gravity	
	km	ratio	hours	Earth days	kg	ratio	m/s ²	ratio
Earth	12756	1.000	24.0000	1.000	5.9736E24	1.000	9.80665	1.000
Mars	6794	0.533	24.6597	1.027	0.6418E24	0.107	3.69	0.376

Composition of the atmospheres of Earth and Mars

	CO ₂	N	Ar	O ₂	CO	H ₂ O
Earth	0.04%	78.084%	0.934%	20.946%	---	~1%
Mars	95.32%	2.7%	1.6%	0.13%	0.08%	0.02%

Composition of the Martian soil from page 53 of *Return to the Red Planet* by Eric Burgess

SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	MgO	CaO	K ₂ O	TiO ₂	SO ₂	Cl
44%	7%	17%	6%	6%	0%	0.7%	6%	0.8%