Memorial to Constance Adams, Space Architect

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I have struggled for a long time with what to say about Constance. I was one of the few people among the Space Architecture community who knew about her diagnosis of cancer. She told me during the first week of August of 2017, shortly after she was diagnosed and about 11 months before her passing.

In May 2015, I confided in her about my own medical misadventure with prostate cancer for which I received radiation treatment, and the subsequent difficult recovery. I understand why Constance told so few people about hers; she was the only on in the Space Architecture world who I told. Constance called me periodically to check on me. In a sense, we "shared" our cancer experiences, but the fact that I survived and she did not makes it so much harder for me to discuss. I would not call it "survivor's guilt," but lack a word for it; my thoughts and feelings move in so many directions at once.

Now, I have been able to consolidate those thoughts and feelings into three "directions:"

1) What I knew, when I knew it, and how I felt about it,
2) How I met Constance and our camaraderie over two decades, and
3) The bonds between Constance and me

What I knew, when I knew it, and how it felt

Normally, when writing a tribute of this kind, one does not devote attention to one's own feelings. That is the rub. My feelings are a large part of it. When I was diagnosed, Constance called me regularly. I talked to her about the tests, the biopsies, the treatment, the long recovery, and always more tests. So, when she told me that she received a diagnosis of stage-4 colorectal cancer, with possible metastasis, I thought I should have been better prepared to serve as the good listener she had been for me. However, I felt utterly unprepared; my heart leaped into my throat and choked me.

There were two reasons, based on past experience. One, my mother had colon cancer. She spent her last seven months in miserable hospitalizations and stints in nursing homes. So I imagined that path ahead for Constance.

In Constance's case, no doctor in Houston would tell her there was a probability of success. I did not tell her that but it seemed cruel to let her discover it for herself, So I did not warn her—a warning would have been worthless. So, despite my tied tongue, I offered Constance what little support, attentive listening, and encouragement that I could.

Telling my children that I had a possibly fatal illness emerged as the most anxiety-laden moment. We got through that talk-you-never-want-to-have, but Benjamin was 27 and Gabe was 23, much older than Mathilde and Valerie. How could Constance bear to tell them? I felt my heart break for all three of them, and I wondered how the girls and Charles would cope. I am grateful for Maryscott stepping in as guardian.

I talked to Constance on the phone somewhat regularly over the next 10 months, but it could never be regular enough. It was hard for both of us to put a bold face on the situation. About a month or so before the end, Constance's voicemail filled up and she stopped answering emails. I texted her and she replied. We did that a few times.

On June 13, Constance texted, "I'm dying Marc and I don't care about Space Architecture."

I asked if she would like to talk.

"No, sorry." She replied.

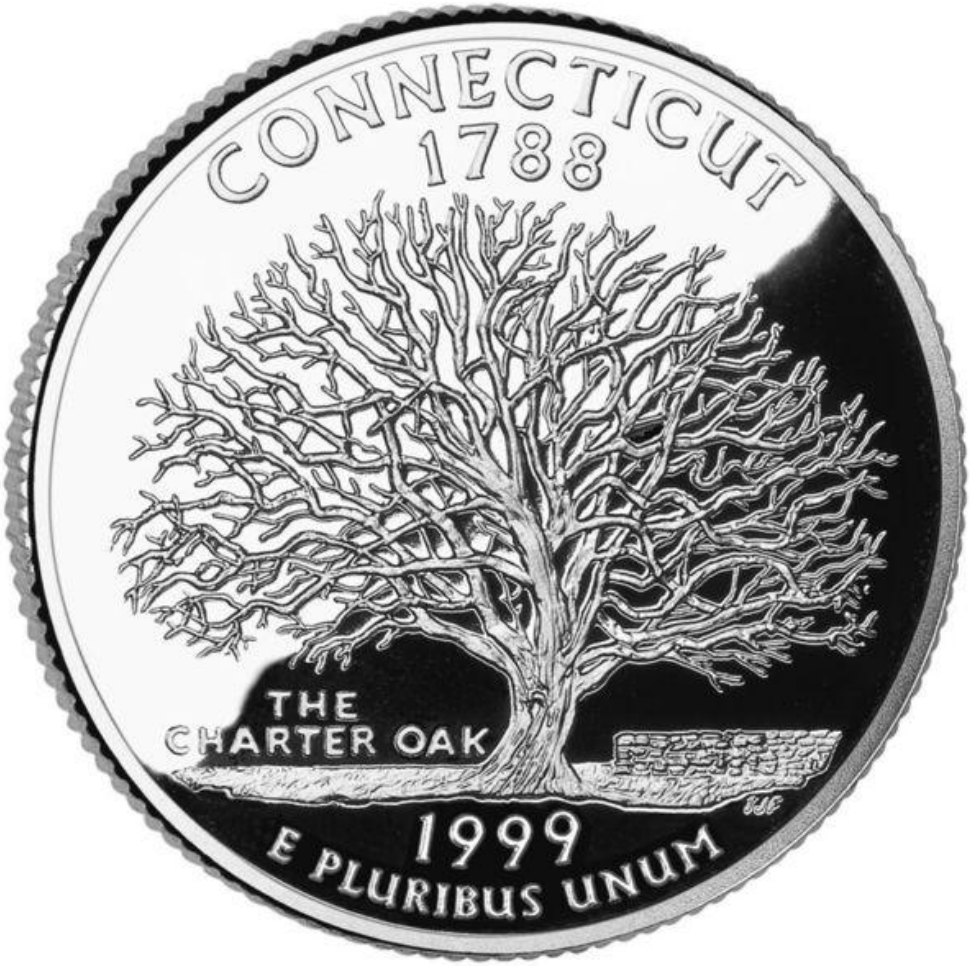
Constance did not suffer fools easily, if at all; much less did she incommode herself about their feelings. However, she was always considerate of my feelings, even in extremis.

How I met Constance and our camaraderie over two decades.

Constance first called me in 1997, I believe, at NASA Ames Research Center, soon after she started work for Lockheed Martin at NASA Johnson Space Center. She was working with Kriss Kennedy on the new TransHab project. Constance was full of questions about Space Architecture, habitability, human factors, all of it. We talked often, in many long phone conversations.

We both grew up in Connecticut, coastal Southern Connecticut to be more exact, Constance in New Haven and I in Fairfield, about 40 km (25 miles) to the west. Connecticut was the first political entity to adopt a written Constitution in the *Fundamental Orders* of 1639, which the Royal Charter from Charles II in 1662 confirmed and augmented. The *Fundamental Orders* established the first government in the world with a written separation of powers into the legislative, executive and judicial branches. Every schoolchild in Connecticut learns the story of how only five years later, the new King James II sent his Governor Andros to confiscate all previous instruments of authority and self-governance to consolidate power under a single governor-general for all of New England. So, the colonists hid their Charter from the British governor in the Charter Oak, and it remains in

Connecticut's possession to this day. This tradition of the importance of written documentation and the preservation of founding documents suffuses Connecticut culture.[1] It went to Constance's and my head, and I believe it played a central role in Constance's later leadership in Team 11 and writing the Millennium Charter.



The Connecticut Quarter Dollar from the 50-States Quarter series.

[1] Constance had another reason to take the colonial period seriously. She was a descendant of Samuel Adams, a leader of the American Revolution in Boston and a signer of the Declaration of Independence.

I think I fell in love with Constance's voice. Her accent, which was subtle but very familiar to me, was the Connecticut Coastal accent, resembling Katherine Hepburn's inland Hartford accent, but not as starchy. I don't know if Constance was aware of it, but some of her colleagues at Johnson Space Centear referred to her as "Cornstarch " behind her back because of her formal bearing, precise diction, insistence upon doing everything the right way, and documenting it properly. Certainly, *I* never told her. Her voice reminded me of many of my public school teachers in Fairfield, who spoke that way — even when they were not using their "teacher voice." We shared stories of strict teachers in public school who gave detentions for grammatical or spelling errors. We recognized each other as fellow *Connecticut Yankees, Constitution Staters, Connecticutions,* and *Nutmeggers,* from *The Little Empire* in *The Land of Steady Habits.*

One of our recurring topics of discussion was how neither of us felt that we fit in living in the places where we lived to pursue our careers. Growing up in a small state with such a strong identity gave each of us a sense of being different — in the same way — amid the transient populations of California and Texas. We both felt that our coworkers in California and Texas were often too quick to accept simplistic answers and to apply them in superficial ways that would not withstand even light scrutiny. Repeatedly, Constance posed the question: "Will we ever go home?" By *home* Constance meant more than a physical place; *home* implied the Connecticut Charter Oak state of mind. Home meant a place where nobody gave us grief for

being too rigorous in our work, for insisting on reasoning through to the logical conclusion and acting on it, or for giving too detailed an answer. *Home* was the place that encouraged the best way we knew how to design, think, and work.

The first time Constance and I met in person was at the 28th (ICES) Conference on Environmental Systems in Danvers, Massachusetts, in July 1998. There, we held the first meeting of the Space Architecture Working Group, which the AIAA Design Engineering Technical Committee (DETC) recently had voted to establish. It was an exciting meeting. Constance brought a lot of fire to the proceedings. The next event was undergoing an upgrade from the SA Working Group to the Space Architecture Subcommittee (ASAC) of the DETC. That may sound like a lot of bureaucratese, but it signified a great advance in 2001.

In 2002, the SASC organized the first Space Architecture Symposium, in concert with the 2nd World Space Congress in Houston, TX. Constance played the lead role in organizing the "Team11/Millennium Charter Workshop" that we held there in Houston. Constance picked the name "Team 11" in part because we had 11 members of the SASC involved in organizing the Symposium and the Workshop and in part to suggest an inheritance from the Team 10 group of mid-20th century modern architects. Her idea was to hold the Workshop to follow-on to the Architecture CIAM (Congrès International d'Architecture Moderne) conferences that the Swiss Architect Le Corbusier and leading Modern Architects first organized in

1928. At the fourth Congrès (CIAM4) in 1933, the group wrote and unanimously adopted the ***Athens Charter***, an idealistic vision of the extension of Modern Architecture to modern urban planning. The ***Athens Charter*** exerted a powerful influence in post World War II reconstruction. Ten architects formed Team10 in 1953 within CIAM. When CIAM dissolved in 1959, Team 10 "kept the faith" and continued to advocate the cause of Modern Architecture and urban planning until 1981. Team 10 continued the role of CIAM in influencing the intellectual trajectory and teaching of Modern Architecture.

To highlight and honor this heritage, Constance invited Waltrude "Val" Woods, one of the last surviving participants in Team 10 activities; her husband Shadrach Woods was one of the original Team 10. We both had Val as a professor: she at Yale and I at Columbia. At Yale, Val became Constance's mentor in architecture. So, Val Woods represented another bond between Constance and me. What I learned from Val was a relentless attention to getting the overarching organizing concept, the structure and the details correct. Constance and I could see that influence in each other. It was quite extraordinary to see Val again after about 24 years, and to realize that she had a strong influence on Constance as well as upon me.

Constance's plan was that the Team 11 Workshop in Houston should write a new ***Millennium Charter*** about ***Architecture in Space***, just as the CIAM wrote and unanimously approved the ***Athens Charter*** in 1933. Constance literally "wrote the

book" on CIAM. Her Master of Architecture thesis at Harvard was (1987) ***The Architecture of Revolution: the C.I.A.M. and the Social Production of Art.***

And so, it happened in Houston. The Space Architecture Symposium and the Team 11 meeting comprised very remarkable gathering that consisted of 46 architects and designers from 16 countries, nearly half of us women (many of whom Constance recruited). The group discussed and debated, proposed and refuted ideas, and crafted language to express our shared motivation. In one day of concentrated effort under Constance's tutelage, the gathering wrote and ratified unanimously[2] the Millennium Charter for Space Architecture. The Millennium Charter sets forth the definition of Space Architecture and describes the key roles that Space Architects serve.

Of course, I could not pass up the opportunity to tease Constance that she had merely retrieved the Millennium Charter from the *Charter Oak* on Wylls Hyll in Hartford. Completely straight-faced, Constance rebutted my suggestion, asserting it was impossible because the Charter Oak fell down in 1856.

The Millennium Charter is posted under "Resources" on the Spacearchitect.org website. When people ask me "What is Space Architecture?" I usually refer them to the Millennium Charter or quote it.

[2] With one yea and two abstentions from scrupulously neutral Sweden.

The SASC continued its path toward independence as its own AIAA Technical Committee, and in 2007, we accomplished that goal. We drew heavily on the Millennium Charter in writing the organizational documents for the Space Architecture Technical Committee. Constance made major contributions to all that effort.

Another bond between Constance and me for about the last dozen years is that when we talked, we always talked about our kids. I confess I had Constance at somewhat at a disadvantage. I met Mathilde and Valerie several times, but Constance never met Ben and Gabe. Especially after Charles and Constance split up, I talked to her more often about childrearing issues and how to deal with the "special children," who each of us had.

Constance's Accomplishments

Many people who know Constance's work have spoken or written about it. I will touch on only a few of her many accomplishments. Constance's first major Space Architecture project was the TransHab inflatable habitat in cooperation with Kriss Kennedy at NASA-JSC. While Kriss conceived this "fat tire" idea for a space habitat, it was Constance who developed the interior structure and outfitting that would make the TransHab a viable habitat module. I consulted for them both during that

formative period 1997-1998. Constance made a good-faith effort to incorporate some of my suggestions such as the human-powered centrifuge.

The TransHab brought far-reaching consequences. NASA licensed the patent to Bigelow Aerospace, which has launched several experimental inflatables, including the Bigelow Expandable Activity Module (BEAM), presently attached to the International Space Station. With her partner Georgi Petrov in Synthesis–International, Constance adapted the TransHab to a lunar/planetary surface habitat called the Surface Endoskeletal Inflatable Module (SEIM), and presented it at the 35th ICES in Rome, Italia, in 2005.

Constance's most profound contributions at a philosophical level were her studies of habitability in space. She approached habitability on both a theoretical and practical level. Up to that time, the people who wrote about habitability were either engineers or psychologists. The environmental control and life support systems (ECLSS) engineers were interested in maintaining a breathable atmosphere for minimal mass and volume. Environmental psychologists were interested in how the secondary attributes of the spacecraft environment — isolation, confinement, and separation from Earth — affected an individual's state of mind and small-group interactions, but they disdained the direct effects of the architectural environment, the *human-environment interface*. Constance was truly was the first to approach habitability as a design property of the architectural conception for a space module,

and to do it in a rigorous and tightly reasoned approached. She published a series of technical papers, mainly at the annual ICES, that establish the theoretical basis for *habitability in architecture*, in addition to offering practical examples. Part of her work in habitability became manifest in the BioPlex project at JSC.

Being truly multi-talented and having the capacity to sustain strong multiple interests, Constance also proved capable in working with flight vehicles. As the space station-related habitability work wound down, Constance developed roles supporting the Japan Space Agency's (JAXA) HTV cargo vehicle and supporting habitability and crew safety on Space Shuttle flights.

The HTV *Kounotori* "White Stork," is the JAXA's cargo launch and return vehicle. Constance's fluency in Japanese made her a valuable contributor for the NASA side in coordinating with JAXA. Constance was involved the pressurized logistics section for design of the interior cargo accommodations, some of the physical integration, and system integration. The HTV has flown six times to the ISS, I believe, with a seventh flight scheduled for September of this year, this month.

For the Space Shuttle, Constance made the transition from project staff to Mission Control flight support, which was an exceptional accomplishment. Constance was "sitting console" for Lockmart in the "back room" during Columbia's final tragic flight; she went off duty on the shift before the fatal descent. When I called her that

terrible day, she was almost inconsolably upset. She spoke for at least an hour. As the following months passed and the incompetence, sloppiness, negligence, and willful malfeasance in NASA came to light, Constance became more and more angry and bereft.

Having lived and worked through the loss of Challenger, I was more sanguine about the risks of human spaceflight. What shocked me most about losing Columbia was that all the fatal errors originated at JSC, which naively I regarded as above reproach in operational matters. Constance had felt much the same way. However, as more and more stories emerged about all the corners that NASA management cut regarding safety and all the preventative steps they could have taken, Constance felt angrier and more bereft—more betrayed. "How can I continue working with these people?" she asked. "How can I ever trust them? How can anyone ever trust them?" The loss of Columbia marked a crisis for Constance, of truly existential dimensions.

Without the Shuttle flying for a long hiatus, Lockmart laid Constance off, which sent her on a protracted job search. She worked for a short period at Futron, Houzz, and with a sort of non-profit outsourcing agency for unemployed aerospace people. Finally, Constance landed a job with Bechtel as a human factors and ergonomics consultant. This job meant she began doing a lot of travelling to distant work sites in Asia, Australia, and other remote locations. That added more pressure to her job as a parent, and she worried about how it would affect Mathilde and Valerie for her

to be away so often. Never the less, Constance carried on and I imagine she performed the job for Bechtel with all the determination and verve she applied to her space architecture work.

Despite all these challenges, disruptions, and traumas, Constance was always responsive to me when I asked her to review one of my projects or papers. Often I felt that while many colleagues expressed respect for my work, Constance was the only one who truly understood it. She understood it in the mode of direct, instant comprehension, without any need for presentation or explanation. In this respect she possessed a rare mind of penetration and instant grasp.

Constance was a good and loyal friend. I miss her deeply.