

## Welcoming Remarks

πόλλ' οἶδ' ἀλώπηξ, ἀλλ' ἐχίνοσ ἐν μέγα.<sup>1</sup>

Archilochus, ca. 710–676 BCE

Schuster, bleib' bei deinem Leisten!<sup>2</sup>

German proverb

Good morning. It's wonderful to see you all here.

Standing up here today I feel very much out of place. Of all the engineers at this symposium, I, perhaps, have the weakest Engineering credentials. As an undergraduate in Physics, I took only a single Engineering course, which I failed the first time and was forced to repeat. As a graduate student in Physics, of course, I took no Engineering courses at all. I was 36 years old before I took my second Engineering course, and 39 before I acquired a slightly shaky master's degree in Electrical Engineering.

When I interviewed for my first job in Astronautics, I had learned only a few weeks before that “attitude” could be applied to something other than people. Now, more than 28 years later, my knowledge of Astronautics, though much improved from those earliest days, remains very limited. I have published Engineering journal articles only in the micro-area of Spacecraft Attitude Estimation. It is, in fact, the only area of Astronautics that I really know. Orbit Determination, Orbital Dynamics and Control, and Attitude Dynamics and Control remain for me almost *terra incognita*. At conferences I usually attend only the sessions on Attitude Determination, because they are the only ones that I can really follow.

Even in Attitude Estimation I have severe limitations. I engage only infrequently in Kalman filter studies, because I am not completely comfortable with the dynamics component. When I do approach that topic, I avoid the many exotic and fashionable flavors of the Kalman filter (unscented, sigma-point, particle, quadratic, iterative, etc.), and stick without exception to the plain vanilla variety with which I have become comfortable. Even so, I much prefer batch least-squares estimation to filtering when I wish to illustrate a point. I avoid the more complex topics like GPS attitude determination or star identification. With regard to modeling, most of my attitude estimation studies have taken place within the framework of one very simple measurement model, the QUEST measurement model, which appeared already in my very first Engineering journal article. I have seldom budged from this cozy corner of Astronautics. If I write so many basic papers applying basic concepts to basic problems of Spacecraft Attitude Estimation, it is because my attainments do not permit me to venture far from the basics. If I have gained the reputation of having laid much of the groundwork for modern Spacecraft Attitude Estimation, it is because I am very much stuck on the ground.

But here I am at this symposium, surrounded by people whose capabilities are so much broader than my own, whose knowledge of Astronautics is far greater than mine, and whose careers by many measures have been more successful than mine. As the governor of California, pondering the unlikely trajectory of his own career, recently averred: America is a wonderful place! I am not so dishonest as to deny that despite (or because of) my limitations I have made a worthwhile contribution to Astronautics (although, I contend, not a contribution worthy of a three-day celebration), nor dare I insist that you, my friends and colleagues, have gone to so much trouble and expense simply to gawk at the emperor's new clothes. I take pride in the fact that my contributions to Astronautics have been of a simple nature, created using simple means, and expressed in simple terms, powered less by intellect than by a lot of hard work. Given my limited education in Engineering in general and in Astronautics in particular, it could not have been otherwise. I take pride also that nearly all of my works have had their origin in the practical support of real

<sup>1</sup>The fox knows many things, but the hedgehog one great thing.

<sup>2</sup>Cobbler, stick to your last!

spacecraft and not in the fulfillment of great principles, and that they are as much a product of the heart as of the mind. I am proud that many of these papers have been helpful to my colleagues who do the real work of attitude estimation. I am not at all unhappy that the most useful have often been the least original. In many ways I think I have been like the character portrayed so well by Buster Keaton in his films of the 1920s, the obstinate, clumsy dolt who through sheer persistence and good luck manages to save the day and win the girl. Today, certainly, I have won much more. I am grateful to all of you for the value you have placed on my work and for the sentiment which you have expressed by coming here.

## My Health

It has not escaped my notice that the timing of this event reflects a certain sense of urgency on the part of the organizers. As John Crassidis put it so delicately a year ago, “we want to hold the symposium while you can still come.” I have, in fact, had serious health problems during the past six years. To tell the truth, I have had chronic respiratory problems since I was a teenager and heart problems for the past two decades. Nonetheless, about six years ago the pace of my illnesses did increase considerably.

In May 1999, only weeks after I returned to Maryland and to industry from my professorship at the University of Florida, my cancer appeared. I underwent chemo- and radiation therapy, got better, and then got worse again, this time due to the progression of my coronary artery disease, influenced possibly by my cancer therapy. In November 2000 I had my second angioplasty, which was my third heart procedure since 1987, after which I began to improve once more. In May 2001 I was diagnosed with diabetes. A month later my cancer reappeared. In the spring and summer of 2002 I underwent a long and intensive relapse chemotherapy, which was very debilitating. Since then, except for very short distances, I rely on a cane. I seldom drove after that and since November 2003 haven't driven at all. In April 2003 I was hospitalized for two weeks with congestive heart failure, then again for another two weeks in April 2004, and then a third time for ten days in October 2004. I can say with morbid pride that I now suffer from seven potentially fatal conditions, not to mention depression, my companion since childhood. My credentials in life-threatening illnesses rival and, perhaps, even surpass those in Spacecraft Attitude Determination.

The bottom line, however, is that I am still alive. I get knocked down a lot, but I seem to always get up again. In fact, I feel much better now than I did a few years ago. I won't be leaving you any time soon. But I am slowing down and rather the worse for wear. Since my cancer surfaced, I find attending conferences taxing, so you won't see me very often. The present symposium is the first professional meeting I have attended since February 2001. I was in better shape then. I wish I could sustain an active life as an engineer, even part time. Nonetheless, I am happy for what I have.

I have a favor to ask of all of you and of your companions at the symposium. Please don't talk to me about any topic related to my health. I may joke about my health sporadically at the symposium, but I prefer that you not pick up the topic. Especially, don't tell me about doctors, clinics or treatments that might prolong my life. My health is constantly on my mind. I would rather that my contact with you during these few days be a distraction from my illnesses than a reminder. Forgive me if I absent myself from a session in order to rest, or if I doze off during a session. Wake me gently if I snore.

## My Great Burst of Creativity

My health concerns have had one good effect. They have pushed me to publish a great deal of work that I had allowed to gather dust for a very long time. For an entire decade, from the end of 1993 until the end of 2003, I published only a single journal article, the expression of a long period of depression. Then, in the fall of 2002, when my prognosis was at its worst, I began to worry that my “legacy” would be lost. Consequently, over a period of seven weeks I sent fourteen full journal articles and two errata to the *Journal of the Astronautical Sciences* for publication. John Junkins has labeled this flurry of activity “the greatest burst of creativity” he had ever seen. In fact, it was only a great flurry of trips to the post office. Half of the articles had already been accepted by the JAS as early as eight years before, and almost all of the rest had been conference reports that required little more than reformatting to become an acceptable journal submission. The first batch of papers has now appeared. A second batch of papers, again with hardly any new work, is in various stages of the publication queue, with a few more still to come, possible only with the help of friendly colleagues. Such was the extent of my backlog. I work much more slowly now, for much shorter stretches, and with much longer intervals between them—what I once could do in a week, now takes months—but I still try to work whenever I feel up to it. Since I don't get out of the apartment

much these days, my publication activity is what keeps me alive. This gives me an entirely new perspective regarding the expression “publish or perish.”

### **My Own Symposium Activities**

I should confess that I have not been a very accommodating guest of honor. When John Crassidis asked my approval for this symposium in May 2004, I consented immediately. After more than three dreary years of cabin fever, one could hardly have expected a different response. Soon, however, the anti-Malcolm began to emerge. I agonized hideously about whether I really merited such an event, hideously because I forced the organizing committee to witness it. I finally stopped agonizing around Christmas and decided just to enjoy the expectation of what was to come. And I meddled in everything, the call for papers, the hotel, the payment method, the plans for the proceedings, the excursion, the symposium name, and even whether Mama Crassidis, the organizer’s mother, should prepare Greek desserts for so large a crowd. I even suggested paper topics to a few attendees, especially when I saw the opportunity for a good survey article. (Kathie Howell can tell you about my oft repeated “dying wish.”) However inappropriate my participation in the symposium preparations may have been, I needed to be involved in something bigger than just me. I hadn’t been for a very long time. Also, I wished to enjoy the symposium during the entire thirteen months of its preparation, not just for the three days of the actual meeting. Occasionally, I nipped a problem in the bud, and I made at least two good contributions, the invitation list and the program. I know these were good contributions, because you and your work were the content. Nonetheless, meddlers are always a pain in the neck, and I have been no exception. It is a testament to the patience and good will of the organizing committee that they have still allowed me to attend. All the same, I suspect that it will be a very long time before they plan a second Malcolm D. Shuster Astronautics Symposium. All of my meddling, however, has had one good effect. It has brought me not only back to life but also back into life. That alone has been almost as great a gift to me as the symposium itself.

### **Acknowledgment**

I want very much to thank the organizers for this wonderful event. I thank John Crassidis for starting it all and for being such a strong supporter of my work even while he was still a graduate student. I may question his judgment but not his sincerity. Landis Markley has been my friend since 1967 when we were still theoretical physicists. For almost thirty years he has been my guardian nemesis, frequently spotting errors in my work (before publication) and making it much better. To my mind he is far more deserving than I of an event like this. I have known John Junkins, who has done so much to enrich our field, since 1982. He is the astrodynamist I most admire, and he has been my staunch ally in many ventures. I have always been in the debt of these three people, and I have little to give them in return. Linda Mehnert, the symposium secretary, has gone to enormous lengths to make this symposium a success. I don’t think that she can be praised enough.

### **My Keynote Address**

My keynote address will take place this afternoon at 5:10. Officially, the keynote address is part of the technical program. Nonetheless, I am happy to have your spouses and other adult guests attend. The talk will not be very technical. In fact it has more quotations in ancient languages than equations.

However, I plan to say some things which some of you will think should not be said at an event such as this and which may even make you angry. Furthermore, it may make you furious if I say them in front of your children. Therefore, I will permit no minors to be in the room while I am delivering my keynote address. I will not deliver any part of my keynote address while there is a minor present. My definition of a minor is someone under eighteen years of age. (Thus, my keynote address is rated NC-17.) I apologize for any inconvenience this may cause.

### **A Serious Complaint**

Despite my joy at being here and despite the enormous debt of gratitude I owe to the symposium organizers, I have a very serious complaint about the organization of this and previous symposia. I expressed

this complaint at the Battin symposium in 2000 and would have expressed it again at the Junkins symposium two years ago, had I been able to attend. I will express it yet again here, this time in writing: The organizers of this august event, however great their gifts in Astronautics, haven't the foggiest idea of what a symposium should be! There, I've said it.

In classical Greece the symposium<sup>3</sup> was a very different affair from what we have been offered here. No respectable woman or young child of the family was permitted to attend. The banquet guests or symposiasts (from Greek: \*συμποσιάστης, pl. \*συμποσιάσται, neither of which are attested in documents from the Classical period, the surviving word, from the same root, being συμπότης, pl. συμπόται) wore laurel wreaths and reclined on divans, generally by twos. Food was plentiful. Entertainment was provided by musicians and dancers, both male and female, often clad in very thin diaphanous garments, by rhapsodists (ῥαψωδοί), who recited poetry, and, of course, by *hetairai* (ἑταίραι), the delightful female "companions" who were rented for the evening and whose dress may have been equally revealing. We won't discuss in this context the participation of young boys (erōnomoi), whom Socrates thought were a shameful part of Athenian upper-class social life.

The festivities began with the formal mixing of the wine<sup>4</sup> the *krâsis* (κράσις, "mixing," which also gives us the family name of one of the organizers). Following the *krâsis* there were numerous libations to the gods and an elaborate banquet interrupted when necessary by trips outside the banquet hall for the purpose of evacuating one's stomach to make space for further feasting.<sup>5</sup> The banquet was followed by still more libations, general excessive drinking, further eating, carousing and the telling of stories sometimes until dawn. I dream of the symposia of ancient Athens, I look around me here, and I ask: where are the dancing girls?

Greek hospitality had some attributes which haven't survived classical times, at least I hope not. As witness to this the Ancient Greek lexicon has numerous words related to the treatment of guests. These include: *xenopâtēs* (ξενοπάτης), a deceiver of guests, *xenodaiktēs* (ξενодаϊκτης), *xenoktōnos* (ξενοκτόνος), and *xenophoneús* (ξενοφονεύς), all three of which mean a murderer of guests, and my favorite, *xenodaltēs* (ξενодаίτης), a devourer of guests. The Greeks, it would seem, have a long tradition, going back to the Mycenaean age, of devouring their dinner guests. Despite my severe criticisms of the present event, I am confident that the symposium organizers (symposiarchs, Greek: συμποσιαρχόν, pl. συμποσιαρχόντες) will take no actions against me describable by any of the above lexical items. All the same, I advise you to check that I am in the hall before you sample Mama Crassidis' baklava.

With that I end my remarks with an ancient Greek toast:

Πίθι ἢ ἄπιθι!

Drink up or go home!

<sup>3</sup>The word *symposium* derives from the Ancient Greek συμπόσιον = συν + \*πόσιον. The preposition συν means simply "with" and is etymologically cognate with the Latin preposition cum (in construct con-). The second element is not attested separately in Ancient Greek but derives from (Ionic) πόσις (Attic πότις, though both dialectal variants were in common use in ancient Attica), which means both "drink" and a "drinking bout." Latin pōtus, an obvious cognate, has the identical semantic range as πόσις. The more frequent Latin word pōtiō and English *potion* mean only the drink itself. In French slang a drinking buddy is un pote (ultimately from Latin pōtus). Russian пиво ("beer"), пить ("to drink") and our *beverage* share the same Indo-European root as πόσις and pōtus.) A *symposium* in Ancient Greece was simply a drinking party. In German we might translate *symposium* root for root as ein *Zusammentrinken*. The word \*compōtiō is not attested in Latin, perhaps, because it would have been easily confused with compōtiō, which means a shared power. Latin uses instead the word compōtiātio, which means "drinking bout." Our event here at best could be called a *convivium*, a dinner party in Latin (literally "a living together," c.f. English "convivial"), and then only for the banquets. The ancient Greek symposium certainly did not include the reading of learned papers.

<sup>4</sup>The ancient Greek upper class never drank untempered wine, which was probably much stronger than our own.

<sup>5</sup>Cicero, in *Pro Rege Diaturo*, reminds Julius Caesar of the latter's earlier statement that he regularly enjoyed a good post-prandial puke (*vomere post cenam te velle dixisses*). From the syntax we may infer that Caesar had not said this to Cicero directly.