

Mr. Williams is head of the Space Systems
Technical Committee of the Am. Inst. of Aeronautics
and Astronautics - I was on his TC until recently.

W. Clark

From: Williams Tony <williams_tony@bah.com>
To: W. Clark <whcii@mindspring.com>
Cc: Steve Saunders <saunders@jpl.nasa.gov>; Steven Matousek <steve.matousek@jpl.nasa.gov>;
 James F Andary <James.Andary@gsfc.nasa.gov>; Dr. Charles Lillie <chuck.lillie@trw.com>
Sent: Tuesday, May 30, 2000 5:10 PM
Subject: RE: SSTC business

Bill

I've cc'd the folks who have an interest in this area -

Gents - what do you think?

thanks

tw

5/31 Emailed .exe file to
all the above individuals.

-----Original Message-----

From: W. Clark [mailto:whcii@mindspring.com]
Sent: Tuesday, May 30, 2000 3:59 PM
To: Williams Tony
Subject: SSTC business

Hi Mr. Williams.

I have been working on optimizing the next Earth to Mars mission (June 2001 is when the next window occurs, at E-M conjunction). I have built a four-body model and integrated the trajectory seamlessly for the entire mission, all the way to/from nominal 100/200 km parking orbits; accurate to fourteen or so digits using an RK 78 integrator, in three dimensions, using elliptical orbits (ie J2000 ephemerides), etc.. I've determined a minimum energy transfer, and am wondering if there is anyone on the committee who can give me some feedback on what the actual missions require, if my numbers are ok, and so forth. If I'm on track, I have a full blown numerical optimization program I can hook up (my poor PC wants hazardous duty pay if I do, though!) From what I can find out about recent Mars expeditions, the numbers are pretty good. If so, I might be able to rustle together something to say at the meeting. Anyway, here's the numbers: Total of 215 days (from parking orbit to parking orbit), using a total of 6.1 km/sec of delta-v's: one on either end (if aerobraking is used at Mars, deduct 1.6 km/sec), and one at conjunction for the plane change. A straight Hohmann Transfer on this model takes 251 days and 6.0 km/sec, which is in the ball park. If anybody is interested, I can provide all the gritty details. (yes, I got there 35 days faster than Hohmann would have, using the same amount of fuel.)

Thanks!

Bill Clark

6/1 Emailed .exe file to:

- (1) Dr. Fowler
- (2) Dr. Broucke
- (3) Dr. Abusali

W. Clark

From: Saunders <rssaunders@earthlink.net>
To: W. Clark <whcii@mindspring.com>
Sent: Saturday, June 03, 2000 2:40 PM
Subject: Re: Mars mission

Thanks, but I leave the details of this sort of thing up to the nav guys. I was just interested in the general concept. They worry about how we get to Mars at a particular longitude and latitude. We have 5 TCMs planned for the 2001 orbiter. We do the first one as soon after launch as possible to get the maximum leverage, i.e. minimum propellant expenditure. We will do the last one only a few hours before MOI, but only if we need it.
Steve

At 01:10 PM 6 3 00 -0500, you wrote:

>Hi Steve.

>

>Seems like most folks think my little program is some kind of hoax. Well, it's not. I've downloaded a copy of a technical paper I've written on the numerical methods used, as well as a copy of the fortran source code, if you are interested. You can access both from my web site, <http://get-me.to/mars>

>

>Regards.

>

>Bill Clark

Dr. Saunders is head of the group at JPL that plans the trajectory for the Mars missions.

W. Clark

From: <Mzubrin@aol.com>
To: <whcii@mindspring.com>
Sent: Tuesday, June 27, 2000 5:16 PM
Subject: The Mars Society

Dear Bill Clark,

Your abstract entitled "Optimizing the 2001 Mars Mission Trajectory" has been accepted for presentation at the 3rd annual Mars Society Convention to be held in Toronto, Canada, August 10th - 13th, 2000.

If you have not already done so, you may register for the convention at the Mars Society website - www.marssociety.org. Session schedules and presentation information will be posted at the web site in the near future.

If you wish to submit your presentation paper for eventual publication, you may send a disk and hardcopy to:

Maggie Zubrin
The Mars Society
PO Box 273
Indian Hills, CO 80454

Or you may hand-deliver a disk and hardcopy to me no later than the last day of the conference.

Maggie Zubrin,
Executive Director

Several representatives of the Mars Society have since shown a keen interest in my project — especially the Mars Society of Germany, the Canadian chapter in Winnipeg, and Bill Kietz at the Southern California chapter associated with JPL.

From: gremaud <gremaud@unity.ncsu.edu>
To: whcii@mindspring.com
Subject: Re: Re: conference paper abstract
Date: Thu, 18 Oct 2001 23:11:17 -500

The web site for the conference is here

<http://www.ncsu.edu/crsc/events/Southeast>

What I meant to say is that you could contribute a 20 mn talk (15mn + questions). We provide overhead and LCD projectors. Would you be interested in this? Please, let me know as soon as possible if that is the case. As you'll see from the schedule, we won't have more than two talks in parallel at any time.

Pierre Gremaud

> Hi Dr. Gremaud,

>

> I'm not sure what a 20 mn slot is. I do have a paper to present, and you can read a rough draft on my web site at <http://www.inviticus.com> on the "UFT?" link. Supporting material for this paper is in links on either side of this one.

>

> Do you have a conference web site where I can visit to learn more about all of this?

>

> Thanks,

>

> Bill Clark

Pierre Gremaud
Department of Mathematics
North Carolina State University
Raleigh, NC 27695-8205
<http://www.math.ncsu.edu/~gremaud>

[view source]

~

N-Body Problem

From: Juris Vagners <vagners@aa.washington.edu>
To: "Bill Clark
P.E." <whcii@mindspring.com>
Subject: Re: optimization research
Date: Fri, 19 Oct 2001 15:19:41 -0700

Hi Bill!

Thanks for your inquiry. I will look at what you are doing & get back to you.

Juris

ps As it happens, orbit mechanics was my PhD thesis area with John Breakwell at Stanford in the 60's. So I am quite cognizant of orbit issues as well as the optimization field, both conventional and unconventional algorithms.

From: Loc Vu-Quoc <vql@galileo.aero.ufl.edu>
To: whcii@mindspring.com
Cc: vql@galileo.aero.ufl.edu
Subject: Re: optimization research
Date: Fri, 19 Oct 2001 15:50:16 -0400

Fri, 19 Oct 2001, 15:44:58 EDT
Dear Mr. Clark:

Thank you for contacting me about your interesting approach of optimization. The description of your approach sounds interesting.

Also, thank you for inviting me to serve on your dissertation committee. I wonder how you found out about me. It would be nice if we could talk over the phone some time. In principle, I would be glad to serve on your dissertation committee; I would like to talk to you to have a better understanding of the circumstances in which you selected me as a member.

Sincerely.

Loc Vu-Quoc, Professor | Tel: (352) 392-6227
Aerospace Engineering, Mechanics | Fax: (352) 392-7303
& Engineering Science | E-mail: vu-quoc@ufl.edu
P.O. Box 116250 | <http://www.aero.ufl.edu/~vql/>
231 Aerospace bldg, University of Florida, Gainesville, FL 32611

From: Marilyn Dudley-Rowley <md_r@hotmail.com>
To: whcii@mindspring.com
Subject: Mars materials
Date: Thu, 18 Oct 2001 02:23:43
Dear Bill,
I would be interested to see what you have.
Marilyn
(Dr. Marilyn Dudley-Rowley, OPS-Alaska)

From: Nicholas A Netreba <netreba@ai-solutions.com>
To: "Bill Clark
P.E." <whcii@mindspring.com>
Subject: Re: software research
Date: Fri, 19 Oct 2001 14:31:23 -0400

Bill,

Your research sounds exciting! ai solutions has supported other research efforts by granting use of our premier software product FreeFlyer. It seems that you may be able to use FreeFlyer based on your research focus. FreeFlyer also uses a Runge Kutta 7/8 integrator (as well as many others including a Runge Kutta 4/5 and 8/9). Perhaps you could use our tool for benchmark and trade study analysis (accuracy of one integrator vs. another, for example). Please let me know if you would like further information.

If you wish to discuss this over the phone, I will be in my office Monday but out the remainder of the week.

Thanks,
Nick

Nick Netreba
a i solutions
301-306-1756 x105

From: beck@plato.la.asu.edu
To: whcii@mindspring.com
Cc: beck@plato.la.asu.edu
Subject: Re: optimization research
Date: Fri, 19 Oct 2001 14:14:12 -0700 (MST)

Hi Bill,
had a short look at your webpage. For a PhD in optimization in a math dept it may not be enough, although one would first have to look closer at things.
From a practical point of view it would be good if you could "prove" that your method beats what people really do in practice and even better if it beats what could be done best by other more standard techniques. The latter may be different from the former because people (at NASA etc) may not apply the best known methods.

Hans Mittelmann

From: "John R. Birge" <jrbirge@northwestern.edu>
To: "Bill Clark
P.E." <whcii@mindspring.com>
Subject: Re: optimization research
Date: Sat, 20 Oct 2001 17:24:25 -0500

Dean of Engineering

Dear Mr. Clark,

Thank you for the message. I am curious about your optimization approach and how it might relate to other methods. I have printed out your papers and will look them over to see what might be possible to say.

Thank you for asking about my serving on your committee. In principle, I'd be interested but it might be logistically a bit hard from here. Have you talked to Leon Lasdon in the business school at UT? He is an expert on nonlinear optimization (e.g., he wrote the nonlinear code implemented in Microsoft Excel's Solver). In Mechanical Engineering, there's also Dave Morton who has a good optimization background. Both are great guys as well. Thanks again and best wishes on your research,
John Birge

Ron

**Dean John Birge at Northwestern said he would be my fifth advisor
In an email message dated 22 Oct 2001**

From: "B. J. Fregly" <fregly@aero.ufl.edu>
To: "Bill Clark
P.E." <whcii@mindspring.com>
Subject: Re: optimization research
Date: Mon, 22 Oct 2001 16:46:29 -0400

Hi Bill,

Thank you for your e-mail message.

Your optimization work sounds very interesting. However, you may not have realized that even though I am in the Aero department at UF, I don't do any research or teach any courses in Aero (funny huh). For historical reasons, much of the biomechanics research at UF is done in the Aero department, which is why I am here. So although I work a bit in optimization, I only do optimization of biomechanical systems. My work is very similar to Dr. Marcus Pandy's work at UT Austin (he is now in the new Department of Biomedical Engineering).

If you have developed a fast new global optimization technique, that certainly sounds worthwhile for a PhD project from my perspective. So I would definitely encourage you to continue down that path. I am not sure I would be the right person for your dissertation committee, though, since I don't work in celestial mechanics. Have you considered trying someone in our Astronomy department?

Kind regards,

B.J. Fregly
Assistant Professor
Department of Aerospace Engineering,
Mechanics, and Engineering Science,
Biomedical Engineering Program, and
Dept of Orthopaedics and Rehabilitation
University of Florida
Tel: (352) 392-8157
Fax: (352) 392-7303
E-mail: fregly@aero.ufl.edu
Home page: www.aero.ufl.edu/~fregly

From: Nicholas A Netreba <netreba@ai-solutions.com>
To: whcii@mindspring.com
Cc: Tim Velegol <velegol@ai-solutions.com>
Subject: Re: software research
Date: Mon, 22 Oct 2001 16:10:27 -0400

Bill,

How about we send you a demonstration copy of our FreeFlyer software. If you like, we could send you a 60 day fully functional license. Just reply to me and Tim Velegol (velegol@ai-solutions.com) with a mailing address. We are currently working on a license agreement for research purposes and will send that to you if you are interested.

Most of our work to date has involved Earth based missions but we are contemplating the move to interplanetary.

Our web site, www.ai-solutions.com , contains more info about FreFlyer.

whcii@mindspring.com wrote:

Cc: Emily Todd <emily@icase.edu>
finnegan@usra.edu
Subject: RE: optimization research
Date: Mon, 22 Oct 2001 09:09:37 -0400

Bill,
I am going to check with a Professor here that is experience in this area. I will get back to you.
Manny

Manuel D. Salas, Director
ICASE
NASA Langley Research Center
Mail Stop 132C
Hampton, VA 23681-2199

"Manuel D. Salas" <salas@icase.edu> wrote:
Bill, Please contact Professor Robert Tolson, George Washington University, at

e-mail: R.H.TOLSON@LaRC.NASA.GOV
Phone: +1 757 864-2798
Fax: +1 757 864-5894

He is interested in your work.
Regards,
Manny

Manuel D. Salas, Director
ICASE
NASA Langley Research Center
Mail Stop 132C
Hampton, VA 23681-2199

From: Steve Wichman <Steve.Wichman@colorado.edu>
To: "Bill Clark
P.E." <whcii@mindspring.com>

Subject: RE: space software
Date: Mon, 22 Oct 2001 08:49:41 -0600

Thanks Bill. I don't know if I was part of some mass-email or if actually selected because of my affiliation with Colorado Space Grant, but because of the latter, your software will probably be used pretty extensively here. I have lots of students excited about Mars and a Mars-related proposal in the works, so this should help. Best of luck on your continued studies and I have your webpage marked. Keep me informed of other

From: Kathy Kaiser-Holscott <naaco@LEECA.ORG>
To: "Bill Clark
P.E." <whcii@mindspring.com>
Subject: Re: space software
Date: Mon, 22 Oct 2001 10:34:36 -0400

Mr. Clark: Thank you for your e-mail to NASA CORE. I am forwarding your message to see if there is a specific department you can send your materials to for review. In the meantime, check on the internet at <http://www.education.nasa.gov>
Kathy Kaiser-Holscott
NASA CORE

Bill,

Thank you for writing NASA Spacelink. You may want to review the information found at the NASA Headquarters' homepage that addresses how to do business with NASA, including information on how to submit an unsolicited proposal. That Internet address is as follows:

<http://ec.msfc.nasa.gov/hq/library/unSol-Prop.html>

Thank you again for writing and best wishes to you.

Heather S. Deiss, NASA Spacelink Program Specialist
<http://spacelink.nasa.gov>
E-mail: deiss@spacelink.nasa.gov

From: Laura Lemire <LLemire@gw.dot.state.ny.us>
To: whcii@mindspring.com
Subject: space program -Reply
Date: Mon, 22 Oct 2001 09:21:00 -0400

Mr. Clark:

Thank you so much for sharing this information with me. It sounds fun! I am going to forward your email to the Aviation Aerospace Education Foundation. I remain on their Board but due to a change in work assignments, I am no longer involved in aviation education which is unfortunate.

Good luck with your endeavors,

From: Bob Cassanova <bcass@niac.usra.edu>
To: "Bill Clark
P.E." <whcii@mindspring.com>
Subject: Re: optimization research
Date: Tue, 23 Oct 2001 13:11:18 -0400

From: Rick Greenberg <greenber@pirlmail.lpl.Arizona.EDU>
To: "Bill Clark
P.E." <whcii@mindspring.com>
Subject: Re: optimization research
Date: Tue, 23 Oct 2001 10:19:19 -0700 (MST)

Hi Bill,

It certainly seems like an interesting topic, with the potential to grow into a meaningful PhD thesis. That judgment would be best left to your advisor of course.

I don't know if I would be the best choice for a member of your committee, because I am not expert in numerical orbit determination techniques, while plenty of other people are.

keep in touch,

Richard Greenberg

Your research certainly sounds interesting and potentially useful to the space program. If you are asking if NIAC would have an interest in receiving a proposal on the subject, I really can't give you a definitive answer. However, it appears that this is an evolution of the general field of trajectory analysis. While it may have advantages over currently existing methods, I'm not sure I would put it in the "revolutionary" category. It may be very suitable as a dissertation topic.

I can't judge whether or not it would be suitable for a PhD dissertation without becoming a lot more informed about the subject and about your approach. So I will leave that decision to your dissertation advisor.

Thanks for inviting me to be on your dissertation committee. I've been on committees before when I was at Georgia Tech and thoroughly enjoyed the experience. Unfortunately, I don't see how I would be able to do it justice. My schedule for the next year and a half is very full with my official duties at NIAC and I can't add this commitment.

Best wishes for a successful dissertation.

Dr. Robert A. Cassanova
Director
NIAC

kampmann@ibk-consult.de wrote:

> Hi Bill,

this is a big surprise getting an invitation for a PhD dissertation defense ... after only asking for the source code ...

Well I just shortly inspected it being Fortran code. I guess I - being from the old days of IT - know enough Fortran to port this to "C" language
the only thing which goes within QNX 6 although being 49 pages :)

Coming to the PhD defense - generally I am interested however being in Germany
that might sum up to quite a task :) - though I could combine that by visiting
my friend in California who is by the way a senior in the aero industry (now 70!
and still active! btw: I am 64!)

Question in particular is: when appr. will that be ?? I suppose somewhere in 2002 !?

I suppose you will keep me informed what your plans are ...

BTW:

You might be interested hearing that I was - abt. 25 years ago - in the geophysical
industry dealing with shipborne satellite navigation for oil-prospection research vessels - the Transit or NNSS system being integrated with a Doppler sonar system for tracking - and since I was 15 dealing with astronomy ... studying physics and after that a bit of astrophysics etc.
etc.

Then in the medical field doing R&D in critical care computing for cardiac surgery post-op critical care wards (SICU).

best regards

Jörg

Robert Tolson <rhtolson@earthlink.net> wrote:

> I would be interested in serving on your committee. Let me take a look at your work and get back in touch with me in about 2 weeks.

Prof. Tolson

From: "Koczor, Ron" <Ronald.J.Koczor@msfc.nasa.gov>
To: "Bill Clark
P.E." <whcii@mindspring.com>
Subject: RE: space program
Date: Tue, 23 Oct 2001 07:36:22 -0500

Dear Bill,

Thanks for forwarding this to me. It looks like an excellent teaching tool and an excellent way to visualize what happens to get a spacecraft from here to Mars.

I've forwarded it to a couple of friends at JPL and also to our tracking person here at Marshall.

From: Katherine Liapi <kliapi@mail.utexas.edu>
To: whcii@mindspring.com
Subject: RE: Building Energy Audit Software
Date: Thu, 25 Oct 2001 01:07:05 -0500

Many thanks!

Regards

Katherine Liapi

Katherine Liapi <kliapi@mail.utexas.edu> wrote:
> Thanks,
I think I'll ask you for that too.

Katherine Liapi

At 11:12 AM 10/24/01 -0400, you wrote:

>Hi Ms. Liapi,

>

>Thanks - let me know if you have any problems with the
>program. I have several typical projects I've done with
>it, if you are interested let me know.

>

>Bill Clark

>

>

>kliapi@mail.utexas.edu wrote:

>> Hi Bill,

>

>Your work sounds very interesting . I'll download your program and I may
>come back with questions.

>

>Thanks you so much and good luck with your dissertation.

>

>Regards,

>Katherine Liapi

>

From: "Dr. Carl T. Haas" <haas@mail.utexas.edu>
To: "Bill Clark
P.E." <whcii@mindspring.com>
Cc: egibson@mail.utexas.edu
kliapi@mail.utexas.edu
jtoconnor@mail.utexas.edu
Subject: Re: Energy Audit Software
Date: Mon, 22 Oct 2001 12:09:22 -0500

Hi Bill,

It sounds absolutely fascinating, and I appreciate your generosity. I am not a buildings expert, but I will copy your offer to my colleagues, one of whom at least should be able to use the program in class.

thanks,

Carl

From: Steve Jaeger <steve.jaeger@rrc.state.tx.us>
To: whcii@mindspring.com
Subject: Software Registration
Date: Mon, 22 Oct 2001 12:38:27 -0500

Steve Jaeger, P.E.
Senior Lecturer
Civil Engineering
University of Texas at Austin
Austin, Texas 78712

512 4639202
steve.jaeger@rrc.state.tx.us

From: Steve Jaeger <steve.jaeger@rrc.state.tx.us>
To: "Bill Clark
P.E." <whcii@mindspring.com>
Subject: Re: Building Audit Software
Date: Mon, 22 Oct 2001 10:09:42 -0500

Bill,
I had problems getting the software to work last time. As I recall the
software seem to load up OK but would not execute.
I will try again.
What are you up to these days. I truss you got the issue with your advisor
worked out.
Steve

From: Kevin Alter <alter@mail.utexas.edu>
To: "Bill Clark
P.E." <whcii@mindspring.com>
Cc: samoore@mail.utexas.edu
mgarrison@mail.utexas.edu
Subject: Re: Energy Analysis Software
Date: Mon, 22 Oct 2001 14:28:24 -0500

Dear Bill,

Thanks for the email. I will forward it to my colleagues who are
actively involved with those concerns, who I expect will contact you
directly.

Best,
Kevin

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