

Grand Challenge Science Meeting Notes March 16-17, 2017 – DAY #1

Grand Challenge Overview

- US, Japan, Norway are the 3 nations flying missions studying the Cusp
- Goal is to attract all researchers from various disciplines – modelers, theorists, insitu researchers, ground based researchers – to *contribute* to the GC
- 3D multi-scale research is the big “Key” to what we are trying to do in GC
- Discussions on MOU on Science collaboration
 - Discussions with Jacob Parsley and Joran
 - Need to have a “statement” signed by US, JASXA, Norway
 - “Statement” is just a non-binding commitment to the goals of the GC
 - MOU takes minimum of 2 years
 - Maybe consider a MOU if GC “campaigns” continue in the future
 - Cover the common data base and public outreach goals/commitments
 - April 6, 2017 meeting in Japan – need to have statement ready for signature
 - Statement will set up the means to get access to data once you join the GC
 - Important to get science data outside the legal realm of MOU’s
 - Science data is meant to be shared
 - Powerful statement in the Space Act? To encourage the peaceful use of space
 - “Statement” should address three major areas – statement about plans/commitment to GC, Joint outreach plan, data sharing plan
 - Who is doing the Statement – Dan Moses, Doug, Joran, Jacob Parsley
 - Draft in work now
 - Need others to review asap

Launcher Status – Svalbard U5 (2nd launcher)

- 1 month state budget will be known and we will know if the funds are provided
- Very expensive to build in Svalbard – over \$4M investment needed for concrete, shelter, launcher; 2/3 of the total cost is for launch pad preparation.
- All approvals are in place to proceed
- Company is working on construction plans and estimates
- Plan to pour concrete this summer; perhaps install shelter & launcher in November
- “Statement” to Andøya Space Center about support for launcher might help make the business case for the new launcher – key points:
 - Svalbard/Ny-Ålesund is the only launch range that you can launch directly into the cusp
 - Should address the potential “new” missions a 2nd launcher would help bring – future business case
 - ICI-6 is a new mission that has been applied for but not yet awarded
 - Could be another mission in the GC main launch campaign?
 - Words on GC Schedule - can’t slip or else it would jeopardize new missions
 - NASA proposal for dual mission accepted and funded; needs this launcher – mission would be put at risk
 - Need by Monday if possible**
 - Dan Moses and Rob should write the draft – HQ and SRPO perspective
 - Hickman/Bissett will help if needed

G-Chaser Overview

- *See meeting presentation for additional information*
- Andøya launch January 1 -14, 2019
- No specific launch conditions
- Payload – no ACS, no recovery system
- Users guide provides TM and Power available, also footprint requirements for the experiments.
- Camp recently cancelled – associated travel cost may have been reason some institutions did not apply?
- Still need to fill a few sections
- Re-issue the IFF forms with a new deadline – can't be too far away
- Should help get a few more IFF forms
- Consider having a camp in the US once missions are selected

SS-520-3 Overview

- *See meeting presentation for additional information*
- Ny-Ålesund launch 6-19 December 6-19, 2017 (launch window; 7-11 UT)
- Mission above 800km; ½ meter diameter; 140Kg payload
- Two stage launch vehicle
- Understand microphysics involved in ion escape process in the top side ionosphere of the cusp region
- We are near solar minimum may need more launch dates
 - Tends to keep cusp further north?
- Very complete payload w/ good suite of instruments – studying waves and particle interactions
- Good mission to test ground instrumentation coordination
- Action to Joran and Kolbjørn to try and get more participation or “collaboration”? at the GC level prior to this first “GC” mission

ICI-5 Overview

- *See meeting presentation for additional information*
- Ny-Ålesund launch January 1 – 14, 2019
- Mission studying waves and particles
- How fast does instability grow during polar cap patch (high plasma density and precipitation)
- Differentiate between wave and turbulence structures
- Most likely an S30 Improved Orion – German launch vehicle team would assemble in December 2018 in Ny-Ålesund.
- Launch in post noon sector when “patch” comes over launch site/trajectory
- First 2-3 days try to launch with most optimal conditions –
 - Clear sky, EISCAT radar showing high density plasma; HF backscatter??
 - 0800-1200 UT is the launch window (wants sunlit plasma density – will launch a little later 0830 UT)

C-REX-2 Overview

- *See meeting presentation for additional information*
- Andøya launch Nov 25 – Dec 9, 2019
- Looking at region where mass density is very high in the cusp
- 400Km region is area under study

- Why is there always a region of enhanced neutral density at 400 km altitude, associated with earth's geomagnetic cusp? Is this enhancement of 30% a lot?
- What is the mechanism that supports this density change?
- Believe the neutral wind is a significant contributor to the very high mass density
- 20 barium/strontium ampules and need to get them into the cusp
- Adding a suite of Petite Ion Probes (Lynch PIPs) to provide in-situ density and temperature of thermal ions. Miniature plasma imager, EPLAS for precipitation, and ERPA to measure electron density and temperature of thermal electrons.
- 8:42-10:58 UT is the main window time on Nov 30, 2019
- Aircraft needed to help ensure we can launch during window
 - Need 2 of three sites clear and no real good place to have a third site
 - Due to need for off-axis site
 - Without A/C Monte Carlo analysis indicated <40% chance to launch in 2 weeks (AI#)
 - With A/C analysis indicated >90% chance to launch in 2 weeks
 - Conde should send analysis to SRPO
 - Proposed home base Ltoqqortoormiit Greenland – commercial airfield?
 - Provides best view angle of releases
- Launch date is Nov 25 to Dec 9, 2019 – would like to go earlier as part of main GC
 - no launcher is available
 - SRPO has workload issues and this is a heavy labor mission
 - NO real Aurora requirement
- University of Calgary has instruments on board
- NOTE – Canadians have 3 instruments on 3 rockets as part of GC – Need to highlight this in outreach plans; Univ of Alberta also has instruments on board

VISIONS-2 Overview

- *See meeting presentation for additional information*
- Dual launch from Svalbard onboard BB X vehicles
- Launch window Dec 4 – 18, 2018, 0800 – 1200 UT
- High altitude ion precipitation
- Study cusp ion outflow
- Use EISCAT to help image ion outflow
- Will use Super-DARN, ASI's, several magnetometers, lots of ground based instruments
- Launches will be 90 seconds apart – same trajectories (not a high and low flyer)
- Splitting the VISIONS payload instrumentation into two payloads
- Burchill has funding for instrument

CAPER-2 Overview

- *See meeting presentation for additional information*
- Andøya launch Dec 4 – 18, 2018, 0800 – 1100UT (will take any window left over from TRICE 2)
- January 1 -14, 2019, 0800 – 1100 UT
- Alfvén waves in the cusp – estimated to drive 50% of the electron acceleration
- Wave-wave interactions?
- Same mission as last time; same instrument suite and TM needs (baseband)
- Needs CUTLASS Radar in addition to EISCAT

TRICE-2 Overview

- *See meeting presentation for additional information*
- Andøya launch December 4 – 18, 2018, 0700 – 1100 UT
- 2 launches 2 minutes apart – high flyer and low flyer
- 2 identical payloads
- Magnetic reconnection on the dayside
- What happens during these non-steady reconnection steps
- Same mission as last time; similar instrument suite and TM needs
- Would like to Co-align the trajectories; E-W dispersion needs to be cut down to enhance experiment
 - Will accept any amount of E-W dispersion reduction even at the risk of losing some apogee
 - Initial study looked encouraging
 - Understand this may be challenging for NSROC to devote staff in lieu of other SRPO commitments

AZURE Overview

- Andøya launch March 3 - 18, 2018, 0700 – 1100 UT – this is an update, at the meeting it was listed as March 19 – Apr 3, 2018
- ASC is supporting German campaign. 2 launches fall of 2017 and 2 launches Feb/Mar 2018. Could impact Larsen March 2018 plans
- Recovery and refurbishment of the German payloads required. If they miss the Feb/Mar 2018 window, the 2nd set of launches would slip out till Oct 2018. A major impact to Grand Challenge if the 40K needs removed to support the Germans

GC Project Team Organization

- Bissett/Hickman briefed the proposed org chart put together by SRPO
 - Understand this was a 1st draft and will be circulated for review (an updated revision has been included in the meeting presentation)
 - Leads will be coming from Norway with Deputy Leads coming from US
 - Allows for good communications on both sides of the Atlantic
 - Recognizes ASC is the Leader of this “Grand” international campaign!!
 - Takes advantage of time zone differences
 - Kjell and Kolbjørn will get comments to Hickman/Bissett who will finalize and send to team for full review – complete by May timeframe?
 - Should also take a shot at roles and responsibilities description
 - All science teams/organizations please send PAO contact information to Keith Koehler to complete the PAO network.

Ground Based Science Instruments Overview

- *See meeting presentation for additional information*
- One major goal of GC is to have more involvement and recognition of the role of the GB instruments in the GC and Cusp research
- Want to be more inclusive of the GB researchers in the data analysis of the GC Cusp data
- GB teams of researchers also need to be committed to the GC
- Individual PI's have done some of the coordination with the needed GB assets already
 - OK for now but should be more coordinated with GC in the future

- Plan is to make “partners” of the GB research community
 - All sky cameras
 - KHO – long list of instruments – recommended teams have researchers at KHO. KHO biggest auroral observatory monitors aurora and neutral winds. Instruments can be operated remotely from Oslo. Recommended to have personnel at the station.
 - GPS receivers for TEC & scintillation
 - SuperDarn
 - CUTLASS
 - EISCAT Svalbard and Tromsø
 - What radar do you want to use?
 - Which mode to operate?
 - Do the PIs coordinate support through EISCAT nations – or directly with individual stations?
 - If each PI goes separately, you may get more actual time overall. If 10 proposals and 8 are in support of SR PIs – you would get 80% time. If the team goes in with one proposal, you may not get as much cumulative time.
 - May and November are the times to propose EISCAT for the next 6 month period.
 - Operations need to be scheduled 6-8 weeks prior.
 - The scnas don’t work very well during the solar minimum because electrons are low. May need to operate in a fixed manner.
- Need to define a lead to help coordinate GB assets for Grand Challenge
 - Joran indicated Kjellmar might be able to help coordinate?
 - Maybe need leads for different areas or assets??
 - Note indicating we might want a lead just on EISCAT??
- Have a note here “Need Statement: separate from the first statement”
 - Do we need a statement of need and support for GB instruments?
 - If so, need to know who should draft, need by date, and from who
- CEDAR is the key to nailing down EISCAT support schedule
 - Need to talk about “world days” – should one be requested?
 - World day mode will run for several days in a row
 - 1st of May and 1st of November schedule set for the next 6 months
 - Action to ensure GC is represented at CEDAR
 - June CEDAR is critical for anything for the next 18 months
- Should consider a meeting at the Fall AGU on GC Ground Based instruments
 - Perhaps follow up with a meeting at Spring EGU in New Orleans?

Collaboration Discussions

- Need to have an “official” list of GCI collaborators
- Need to have the terms of becoming an official collaborator clear in the statement
- Statement should address the following
 - State of what the GC is all about
 - The goal (intention) of GC is to involve new partners
 - Describe the practical means of sharing data - SIOS (Svalbard Integrated arctic Observatory System)
 - Agreement as a collaborator to provide data in a useable format in a reasonable time
 - It should describe what you get by becoming a GC collaborator

- Doug indicated he would put out draft of this statement ASAP
- Exchange of data recommended through SIOS – Standardized Integrated arctic/earth Observatory System?
- GCI collaborators will have exclusive use of the GC data for 2-3 years and then it would be open for anyone to use the SIOS resources
- Action to organize the GC site on the SIOS? Who?
- Need to determine how to deal with users outside the official collaborator community
 - NASA is required to publish all data

ITAR Considerations

- NASA Std ITAR issues with shipment of hardware
- TAAs with ASC – NSROC
- TAAs with FN payload team members
- Integration hall – G-Chaser may need to be in a separate integration hall – at minimum a curtain between G-Chaser and other payload(s)
- Ny-Ålesund – ICI5 and VISIONS – may need separate integration space – at a minimum a curtain between G-Chaser and VISIONS

May 2017 Logistics and Operations Meeting at WFF

- Operations personnel, TM leads, MMs, TM Es, ROC support
- Targeting May 24-26

Athena Launcher

- The 2 German missions – need both launchers
- PMWE – German missions – PI launched over the past 30 years.
- 2 Rockets this year and 2 next year in salvo (October 2018, Feb/Mar 2019)
- German/Sweden/Norwegian collaboration – sponsored by DLR
- Most likely single stage Improved Malemute motors – may be the Brazilian S-30 single stage (if payload gets too heavy for Improved Malemute)
- The second set dependent on recovery and refurbishment of payloads. If can't meet the Feb/Mar 2018 timeframe, would slip to October 2018
- Need two launchers
- ASC/DLR telecon next week. Will get the motor information from them during the telecon.
- State Dept. – we will provide a brief like we normally do. Anything that would help us to present the project will help. Also help if the motors are from a country that is part of the MTCR.
- If State Dept. doesn't give approval. ASC won't be able to get a new launcher in place prior to Summer 2018. However, a German launcher would be available (this launcher is currently in Sweden). Would need to remove Athena for the German launcher.
- Athena would have to come out in May 2017.
- Talking about making a second modified U5 (with retract lugs) to replace Athena (like U5 slated for Ny-Ålesund).

Radar

- Two Radars at ASC
- ASC owns 1 Radar (Germans own the other)
- What polarization does the ASC Radar support?
- Radar is located 30 km to south of ASC

Grand Challenge Science Meeting Notes March 16-17, 2017 – DAY #2

Public Outreach Discussions

- Need to create a Communications Plan – Karen Fox agreed to start the first draft
 - Plan will be put through NASA Headquarters OIIR review amongst others – (Office of International and Interagency Relations)
 - Plan needs to fit within larger NASA “messaging” process
- Noted that “good news” is often hard to get out to the public
- Social Media needs to be big part of any communications planning
 - More targeted audience that is interested
 - Small video clips are very useful – considering using the clip Kolbjørn had and maybe enhancing it as a start to get the word out about the GC Cusp Initiative
- Need to pull in the cultural aspects of the Aurora/Cusp studies
- CUSP needs to be the focus of the GC communications – easily explained
- International participation needs to be another central theme
 - International partners-Aurora-Rockets are interesting threads we can build on
- Who we target is often difficult – not everyone is interested in good news
 - Facebook and Twitter plugged in through NASA links will target folks who are interested
 - FB is a great venue but needs to have someone dedicated to keep feeding it
 - Only way to keep audience interested
 - Already a FB page for G-Chaser
 - SPRO should consider a FB page to help coordinate “all Campaigns” of which GC is one??
 - Might be best “link” to the GC campaign
- Need a POC at JAXA (Japan) to help coordinate communications plan
- Need Canadian POC as well
- Need POC’s for all universities and institutions who are contributors for communications plans
- Need to create a list of all agencies, institutions, universities, companies, who are GI collaborators and their contribution or instrument they are providing**
 - This includes all Ground Based instrument collaborators
- Need to get local media at each institution involved to help get the word out
 - Job of communications team to make sure local Public Affairs is engaged
 - Need to encourage them to “contribute” to the GC media campaign
 - We can offer them materials to use (like the GC video)
 - Our main site can offer links to each institutions site showing their “contribution” to GC in more detail with more emphasis on their over institutions contribution
- Need to develop a complete list of GC participants and their contact info
 - Hickman has a start and will update and add as the team grows
- Idea for a video graphic – Use the video Kolbjørn had, add an Aurora or Cusp to the animation, and show a graphic of the GB instruments view of the event.....with all the rockets flying through and over it
- Public Affairs/Communications Team needs to have folks in the field
 - All phases need to be covered if really done right – from inception, to building things, to testing, through the various phases of the launch operations, and even presentation of papers/talks/meetings
 - Travel cost is usually the biggest hurdle; along with paying salaries
 - Some staff funding is covered

- Any “large” extra things like large movies or heavily graphics editing may require extra funding but a lot is already covered
- Communication team should determine if there is a documentary crew interested in doing a special on GC from cradle to grave
 - There may be a group in the UK who is interested and they target BBC and PBS
- Communications Team will target 2-3 weeks to get a draft communications plan out to the team for review
- Need to set up a repository of images and materials to be used by the communications team
- A good “Story” to be told by the GC experience (as shared by Joran) is thinking of the GC campaign as a “hunting story”. All our researchers are hunting for the data to try and understand what we are seeing and observing in the CUSP; part of the story are very challenging such as trying to make the launch decision.....a very big key to the getting the right data. Nature is so variable, this is a very hard decision to make. Idea to get the community to “help” make the decision when to launch will get many folks interested. (Maybe some of the practices when we would have launched and would not have launched?)

Window & Window Sharing Discussions

- *See meeting presentation for additional information*
- Generally a 4 hour window for ATC, but can add an hour if it doesn’t interfere with air traffic
- December 7 – 19, 2017 Ny-Ålesund
 - JAXA SS520
 - 0700 – 1100 UT
- March 3 – 18, 2018 Andøya (March 19 – Apr 3 reported in the meeting)
 - 51.001 & 51.002 Larsen AZURE
 - 2100 – 2200 UT
- December 4 – 18, 2018 Andøya
 - 52.003 & 52.004 Kletzing TRICE 2
 - 52.005 LaBelle (if TRICE 2 launches early)
 - 0700 – 1100 UT
- December 4 – 18, 2018 Ny-Ålesund
 - 35.039 & 35.040 Rowland VISIONS 2
 - 0800 – 1200 UT
- January 2 – 14, 2019 Andøya
 - 52.005 LaBelle CAPER 2
 - 46.018 Koehler G-Chaser
 - 0700 – 1100 UT
- January 2 – 14, 2019 Ny-Ålesund
 - ICI5
 - 0800 – 1200 UT
- November 25 – December 9, 2019 Andøya
 - XX.XXX Conde C-REX 2
 - 0800 – 1200 UT? For November 30 the window would be 0842 – 1058 UT
- For TRICE/VISION window share
 - TRICE will be prime early in window – switch over to VISIONS 2 at 1000 UT
 - VISIONS needs clear sky which might be reason for priority
 - Seems both PI’s can come up with a reasonable plan

- G-Chaser – might be some desire to launch at night however they are launching with CAPER who's window is 0700-1100 UT
 - CAPER will drive the window time until it is launched
 - After CAPER launches, we could go at night – although this could cause a airspace/surface scheduling issue.
- 2018 last working day in December for ASC is 21st of December (Friday)
- Will need to plan on CAPER integration prior to TRICE
 - Same experiment team so overlap would be tough to count on TRICE and integrate CAPER at same time
 - CAPER needs to be on the rail prior to Christmas holiday break
 - CAPER team could leave once integration is complete (maybe a few days into the TRICE window?)
- Need to establish shipment dates ASAP as teams need to work backwards to get the integration dates set very soon
- No other issues noted for window sharing??

Future Meetings Discussions

- CEDAR 2017 - 18-23 June - must attend for EISCAT support
- AGU – should do something to focus on the CUSP – maybe have a session proposal on CUSP?
- Use 23rd ESA-PAC Symposium as a chance to have a GC campaign meeting
 - Canada, JAXA, NASA, SRPO, ASC, Experimenters, PI's.....may others will be there and might be a good opportunity to meet for planning
 - Might also be a good opportunity to pitch GC
 - May plan a site survey of Svalbard on the front end of this symposium
 - Conference is 11-15 of June
 - Early bird registration ends March 26; decisions should be made quickly as tickets need to be purchased

Ops Discussions/Meeting

- Bissett briefed the various TM options under consideration by the joint team
- Team does not believe we can be in the air at the same time due to S-band spectrum limitations (to be verified)
 - Major consideration in TM site planning at each location
- Both ASC and NASA will concentrate on the proposed concept of having ASC provide full TM coverage at ASC with NASA providing full TM coverage in Ny-Ålesund
 - Will minimize cost to both NASA and ASC
 - Additional risk can be mitigated with good TM acquisition and coverage plans
 - No need for KSAT or SVALSAT tracking as each site can back up the other
 - ASC 10' TM systems may augment NASA at Ny-Ålesund (if feasible)
 - Other options for more redundancy at each site have been discussed and will be evaluated as team moves forward toward operations meeting
 - Current Baseline TM Support
 - Andenes – ASC 7.3M, 20ft, 2 10 ft
 - Ny-Ålesund – NASA 7M, 20ft, Supervan, MPS4, 2 ASC 10 ft
 - Andenes payload testing support – horn on top of PAB, or perhaps setup one of the ASC 10 ft antennas at Toften
- Ops Meeting tentatively planned for 24-26 May at Wallops

- Needs to be confirmed ASAP
- ASC to provide NASA telemetry masking for Ny-Ålesund TM site looking both south towards ASC and north towards the proposed TRICE impact points
 - NASA needs relatively quick to move forward with coordination with Wallops Range on asset allocation

Various Actions Discussed at Wrap Up (there may be more from the notes)

- G-Chaser – reissue AO for proposals with extended date. (AI#3)
- Make sure King Air is available for C-REX. Can it operate out of Ltoqqortoormiit Greenland? Is the airfield a commercial airfield?
- Canada has instruments on 3 payloads – should they be included on the international scope.
- Begin working on Project Team assignments – John and Kjell.
- Please send slides that have been presented and he will compile into one presentation for all.
- Joran to work with EISCAT team to discuss world day support?
- Joran to apply for a previous results/GCI session at Fall AGU
- Develop official list of GCI collaborators
- Organize GCI site on SIOS
- Send PAO POCs for each organization to Karen Fox
- Determine shipping schedule
- Determine Integration schedule
- Determine SRPO operations support schedule.
- Determine antenna masking for Ny-Ålesund TM Assets – how far can they track the Andøya missions?
- Install stable oscillators to ensure ASC TPS system can be used as an acquisition source in all missions. Azure needs attention ASAP if not already in work.
- ASC provide polarization of ASC (and German?) radar to Wallops ASAP.
- Both ASC and SRPO consider adding C-Band xponder to ASC missions as an additional acquisition source.
- Contact Calgary about cancellation of space camp to see if they want to reconsider submitting IFF form.
- ASC and SRPO confirm AZURE launch date availability.
- Deadline for memo signature is April 6. Provide draft or final for review by Monday or Tuesday next week. Joran and Doug have already begun putting the statement together
- Need support letter next week from Dan Moses to Andøya Space Center. Address to Kjell Boen. (or Odd Roger.....ASC advise on this). The letter to assist with getting the launcher should focus on possibilities for future use, importance of support for Grand Challenge, game changer for launching directly into cusp. NASA has accepted, approved missions that require this launcher.
- Should team consider an all-sky imager in Greenland for campaign? Perhaps near where aircraft might base? Is the site too far south for appropriate coverage? Perhaps a new collaborator?
- Send out a comprehensive GC contact list. Add Mobile #, function, team, and/or GC contribution column to list??
- Line of sight issue to the Payload Integrations Hall at ASC needs to be worked. Will a horn on PAB be acceptable, or do we need to place an ASC 10ft antenna at Toften?
- Inform teams that no cell phones or Wi-Fi is allowed in Ny-Ålesund as it is an RF sensitive environment. Hook up to the internet via hardwire is permitted and is usually very reliable

- NASA needs to work the communications issues with the appropriate authorities (or WFF Test Director) for launch coordination. No Wi-Fi or Cell use in Ny-Ålesund. Space Command will only call a US number. Will need to determine Con Ops for Ny-Ålesund launches.
- GC team should create an action item tracking list.....last minute addition!!!