Report of CEDAR Workshop
Developing small rockets for mesosphere and lower thermosphere research (50-120 km)

held on Wed 27 June 2018, 13:30 - 15:30,
in Santa Fe, NM

Weblink:

Conveners: G. Lehmacher, A. Barjatya, (D. Rowland, J. Snively)

Participants: about 30 (incl. speakers)

Speakers:
- Gerald Lehmacher (Clemson University): Introduction
- Rob Pfaff (NASA GSFC): Background

Rob Pfaff gave a brief overview about the history of small rockets and the ongoing discussions in the Sounding Rocket Working Group (SRWG). Documents and findings are linked on the workshop webpage. With the retirement of Frank Schmidlin, also basic “Met-rockets”, such as passive falling spheres and data sondes are no longer supported and/or available.

- Nathan Empson (NASA Wallops Flight Facility): Mesospheric Rocket Requirements Solicitation

Nathan Empson presented an overview about the NASA Sounding Rocket Program. The latest developments are multiple small payloads (ampules, bobs). Development of payload-to-payload communications is underway to reduce need for many ground stations. Nate presented the questionnaire to solicit input from scientific community. The questionnaire is linked to workshop webpage and the call has been sent out to CEDAR and AGU-SPA mailing lists.

- Doug Rowland (NASA GSFC): Multiple-launch campaigns

Doug Rowland presented a previous proposal (MWAVE) to launch many falling spheres (Viper-Dart), instrumented dart payloads and few, larger sounding rockets to study the propagation and breaking of mountain waves over Scandinavia. Launch sites in Andoya and Kiruna, windward and leeward, would be used.

Sven Bilén presented the development of the Super-Loki dart payload carrying a fixed-bias electron probe. Size, mass, communications and many other specifications were provided. Flight tests were successful, albeit apogee was low. Similar small Viper-Dart payloads were developed by Norwegian scientists. Sven also remembered his late colleague Jack Mitchell, a pioneer in mesospheric conductivity studies using supersonic parachuted payloads.

- **Edgar Bering (University of Houston) and Jim Roeder (Aerospace Corp.):** Rocket Studies of the X-ray Flux in the High Latitude Mesosphere and Stratosphere

Edgar Bering presented past experiments also with supersonic parachuted Super-Arcas payloads to study energetic particles and X rays. The small payload mass was emphasized. The loss of expertise with such systems was acknowledged.

- **Jonathan Snively (Embry-Riddle):** Visualizing and interpreting tracer transport by nonlinearly dissipating gravity waves

Jonathan Snively gave a motivation for multiple launches and multiple spatial soundings based on modeling of gravity wave breaking and turbulence in the mesopause region.

- **Miguel Larsen (Clemson University):** Ampule payloads

Miguel Larsen presented the ampule technique, for which subpayloads are released on upleg from the main payload and small rocket motors propel them to reach tens to 100 km separation distance on downleg. The ampules contain chemicals (barium, strontium or TMA) to observe winds and ion drifts at multiple locations. C-REX was the first successful scientific campaign, the next campaign will be AZURE.

- **Kristina Lynch (Dartmouth College):** From Pucks to Ampules to Bobs: development of instrumented telemetered small payloads for multipoint arrays

Kristina Lynch presented the development of multiple instrumented subpayloads for auroral studies. The latest project ISINGLASS contained 4 cylindrical, spring-deployed subpayloads (bobs). Communication networks are also being tested on balloons. Kristina also gave an outlook on SubTEC-8 project with internal communications.

- **Boris Strelnikov (IAP):** New rocket instrumentation for turbulence studies

Boris Strelnikov presented turbulence payloads developed in Europe. The next project will include three subpayloads with smaller CONE neutral turbulence instruments. The collection of mesospheric dust particles requires small payloads, since particles will be deflected in supersonic flow. A small Viper-Dart payload has flown including a radio propagation experiment (TU Graz). Small rocket motors with darts are under development by T-minus (Netherlands) and KTH (Technical College) Stockholm.
• Jim Clemmons (Aerospace): Requirements for small turbulence payloads

Jim Clemmons explained the need for many rocket soundings in time and space to compare with the 3D evolutions of gravity wave breaking and turbulence simulated by Dave Fritts. For a cubesat he has developed a smaller version of his ionization gauge experiment.

• Don Hampton (University of Alaska): Sampling E-region winds in the auroral zone

Don Hampton presented a proposal to launch hourly chemical (TMA) releases to observe the development of lower thermospheric wind under auroral forcing. Smaller payloads with chemical tracers would be needed to accomplish such a sequence.