1. Introduction

This report provides an overview of the work of the Team during the past year. The current list of members of the Team is attached as Appendix A.

Since 2010 the Team has been dependent on a WMO Trust Fund to support its activities. A request was sent to the Permanent Representatives of the WMO countries to request them to contribute to the fund. While the initial reaction to the request has been extremely limited, during the past year several countries have shown interest to make contributions. Considering that weather modification activities in most countries are conducted outside the auspices of the Meteorological Services in separate government departments it is not surprising that very little response was received from the Permanent Representatives of members of WMO. However, there are now several indications that contributions to the Trust Fund will occur in the coming year.

Many countries are still using the WMO statements on weather modification including the guidelines. Although the Expert Team meeting in China did not materialize due to insufficient funding, there now seems to be enough funding to plan a Team meeting early in 2015 in Thailand. The new Department of Royal Rainmaking and Agricultural Aviation (DRRAA) will help sponsor the meeting. The meeting will be finalized before the end of the year.

2. Current status of countries active in Weather modification activities.

During the past year the countries active in weather modification activities have grown in number and individual program in several countries have also increased such as in the USA. While the total number of countries active in weather modification programs in 2013 was 47, this has now increased to 52 countries with the additions of the Sultanate of Oman, Yemen, the DPRK, Kazakhstan and Tajikistan. In addition, several new programs were started in individual countries including the USA (new programs in the States of Texas, Colorado and Wyoming to enhance winter snowpack). Many countries use the WMO Statement on weather modification and the guidelines to start their individual programs. The Team members provided individual guidance to several countries for their programs. More countries are also starting to use this technology as a long-term water resources management tool instead of just during drought periods.

Although the Team meeting China mentioned last year did not materialize because of lack of funds to support the travel of the Team members several international meetings of importance did take place during the past year that have impact on the Team work. During the past year Roelof Bruintjes gave lectures at the WMO International Training Course on Weather
Modification in Beijing, China sponsored by the Chinese Meteorological Administration (CMA) in August 2014. In addition, several Team members were invited to a meeting in Abu Dhabi to discuss a new grant program for rainfall enhancement cloud seeding efforts in arid and semi-arid regions in the world. This program is further described below. The last major meeting of interest is a meeting organized by the Bureau of Reclamation (BREC) in the USA in late November in Denver, Colorado. Until the early 1980’s the Bureau of Reclamation was the primary sponsor of weather modification research programs in the USA with funding of more than US$15 million per year. Recently the Bureau of Reclamation has again started to provide funding to support research activities in the western United States.

Approximately 50 people attended the International Training Course on Weather Modification that was held in Beijing, China from 18-29 August 2014. While most of the attendants were from provinces in China, about 14 persons representing 10 other countries also attended the course. I have attached the schedule of the course, the attendant’s list and a short synopsis of the presentations that were given on behalf of the Expert Team to this document. Although the course was well organized and attended it may be worthwhile in the future to enhance its international focus and to have some more thought put into the course content. The idea of the course is great, but especially with technologies rapidly developing and many countries not really familiar or inexperienced with the technologies, it is difficult to address and convey all the issues in such a short time. One idea would be to have the presenters provide a paper of their work that could be compiled into a report. The Expert Team in its last meeting also identified the need for comprehensive review report or book in this field. It was also clear in some of the presentations that although some countries have acquired new advanced instrumentation for their research, they often lack the experience on how to use these new tools in their research programs.

The meeting in Abu Dhabi in the United Arab Emirates in October 2014 was sponsored by the National Center for Meteorology and Seismology (NCMS). The workshop was organized to discuss a new UAE research program for Rainfall Enhancement Science in Arid and Semi-Arid regions of the world. The higher authorities in the UAE have provided approximately $3 mil per year for this future grant program. The focus of the meeting was to identify critical research needs in this field that would have to be included in the Request for Proposals (RFP). The meeting was co-organized by ScienceWorks Inc. in the USA that is contracted to help develop the administrative structure of the grant program for NCMS. The previous Chief Scientist of NASA in the USA was leading the ScienceWorks group and six members of the WMO Expert Team and representatives from WMO, South Africa, University of Belgrade and MASDAR University in Abu Dhabi attended the two-day meeting. The announcement for the request for proposals will go out early in 2015 and the idea at this stage is to award about two grants each year with approximately US$500,000 per year for three years to the successful applicants. The RFP will be widely distributed internationally and is not limited to only research in the United States.
Arab Emirates. This is an exciting new opportunity to enhance the science in weather modification. The agenda for the meeting is attached.

The last meeting that was mentioned is the Bureau of Reclamation meeting in the USA on 25 November 2014 in Denver, Colorado. While the Western Governor’s conference in the past few years have included again cloud seeding to enhance snowpack in their alternative sources for water resources document, the Bureau of reclamation has in the past few years again became involved in supporting research in this area. Currently the Bureau is evaluating how to become more involved again in this field of research and the purpose of the meeting in November is to evaluate the current status and how the Bureau should become involved. The agenda and associated documents for the meeting are attached.

Based on these meetings and the increase in activity in the field of weather modification globally over the past year and the prospects for substantial additional funding for research in this field in the future it remains important to maintain the work of the Expert Team and provides also for a new dimension of the work of the Team.

3. Trust Fund activities and meetings.

During the past year several team members in coordination with the PR’s have approached entities that are active in this field in different countries with the result that several entities in countries such as China, USA, Russia and South Africa have come forward with potential contributions to the trust fund. We anticipate that early in the New Year some of the contributions will reach the trust fund. These contributions will come from a variety of different entities including government agencies and the private sectors, all of which have an interest to further the science in this field and to support the work of the Expert Team. We anticipate that once the initial contributions are received that other countries and entities will start to participate also. This may call for a different approach to obtain funding for the Trust Fund supporting the Team work by directly identifying the entities that are involved in weather modification activities and then approaching them through the PR’s.

Because sufficient funding is now available from different sources the plan is to organize the next Expert team meeting in Thailand sometime in March 2015. The DRRAA has agreed to host the meeting and provide local support for the meeting. The purpose of the meeting would be to review the WMO Statement and guidelines on weather modification activities, review the global research opportunities in this field and discuss the need for a new review document in this regard.

4. Weather modification and geo-engineering

During the past year WMO established an Ad-Hoc Team to help WMO to develop a statement for WMO on Geo-Engineering. The Team was co-chaired by the chair of the Expert team. The Statement and guidelines taken form the Oxford principles are attached to this document. The
statement closely follows the Statement of the American meteorological Society on this issue. In the past year again there has been a large body of literature in this field.

5. **Recent scientific achievements**

We will wait until the meeting in Bangkok to update the list of achievements in the field. One reason is that the final results from the Wyoming Weather Modification Pilot Project (WWMPP) sponsored by the State of Wyoming with participation of the University Wyoming and the National Center for Atmospheric Research (NCAR) will be published early in the new-year. This program had a major observational component (Breed et al, 2013; Geerts et al., 2010), a numerical modeling component (Breed et al., 2013; Xue et al., 2013a and 2013b) and a randomized cloud seeding experiment that started in 2006 and completed during in early 2014.

6. **Conclusions and future work**

Based on the previous paragraphs it is clear that weather modification activities are still abounding around the world and several major research programs in this field have been initiated in the past few years which in my view emphasize the legitimacy and need for the Expert Team. Although the contributions to the WMO trust fund for this activity have been very limited this is to some extent to be expected for reasons mentioned earlier. In the meantime the Team has been working with the CMA and their course on weather modification and hope to convene its next meeting early in the new-year in Thailand. The immediate plans for the work of the Team are as follows:

a. Convene the next meeting of the Team in Thailand in March 2015.

b. Adapt the approach to solicit contributions for the work of the Expert Team by including the agencies and private industry in countries that are active in the field of weather modification.

c. Review the current status of weather modification activities

7. **References**


Appendix A

**Expert Team on Weather Modification Research**

<table>
<thead>
<tr>
<th>Family Name</th>
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