

## EXHIBIT 10-A

### **Initial Thoughts Regarding the Feasibility and Associated Costs of Using Cloud Seeding Technology to Increase Rainfall in the Carmel River Watershed, California (Nov 2007)**

The feasibility of using cloud seeding technology for precipitation increase in the Carmel River Watershed (CRW) in Monterey County, California is addressed in the following sections.

#### Precipitation Production and Cloud Structures

The winter months are the wet period in this section of coastal California. Precipitation is produced primarily by mid-latitude frontal systems moving onshore from the Pacific. In the winter storms affecting this area, well-defined convection bands embedded in the overall cloud mass traverse the watershed, producing a significant proportion of each storm's precipitation. Each organized storm will contain at least one of these convection bands, and in many cases two. The best organized bands occur pre-frontally and also with cold fronts. Convection bands can also occur post-frontally, but these bands are commonly less intense and shorter-lived. Compared with the more stratiform portions of winter storms, the convection bands are more dynamic and can be readily identified by weather radar. They contain stronger internal upward vertical motion (updrafts) and higher concentrations of supercooled liquid water, resulting in higher precipitation rates. Their characteristics make them very good candidates for rainfall augmentation via cloud seeding. A radar image sequence showing convection bands over/near NAWC's Santa Barbara County project area are shown in Figure 1.

#### Applicable Weather Modification Research

The results of randomized cloud seeding trials in the Santa Barbara II research experiment indicated 20-30% average increases in rainfall due to seeding. The results were found to be statistically significant at the .05 level at a number of precipitation observation sites, a very high level of confidence that the cloud seeding did cause the precipitation increases.

#### Prospective Cloud Seeding Techniques

Ground-based seeding could be accomplished in the CRW, using a method shown to be highly effective in the Santa Barbara II research work conducted in the Santa Barbara (SBA) County area during the 1960's through the mid 1970's. Automated High Output Ground Seeding Systems (AHOGS), using fast-acting glaciogenic nucleating materials released by combustion of high yield flares, would be well suited to accomplish the seeding of passing convection bands. This specific technique has been used on NAWC's cloud seeding project for

portions of Santa Barbara County and southern San Luis Obispo County, beginning in 2002.

An aircraft could also be used to conduct the seeding operations. Airborne seeding offers the prospect of direct injection of seeding material into the desired cloud regions. Fast-acting flare or solution formulations can be used. Aviation is a considerably higher cost method (the aircraft lease fee, plus pilot, on-site meteorologist, maintenance and fuel costs) and can present some operational and safety issues/limitations during stormy weather.

Some seeding projects combine ground-based releases with airborne treatment, contingent upon adequate funding levels and the associated benefit/cost ratio.

### Potential Project Design

Budgetary factors bear upon the project design. A step-wise approach to project design, beginning with a "core" project is helpful in such situations. Given the documented positive effects of seeding experiments in SBA, which have good application for the CRW, the AHOGS ground-based seeding approach is a good option as the basis of a core project. It is less costly than aviation and constitutes the best option from a benefit/cost perspective. Aviation could certainly be added, but should be assessed in terms of the benefit/cost associated with the incremental increase in precipitation that could be expected.

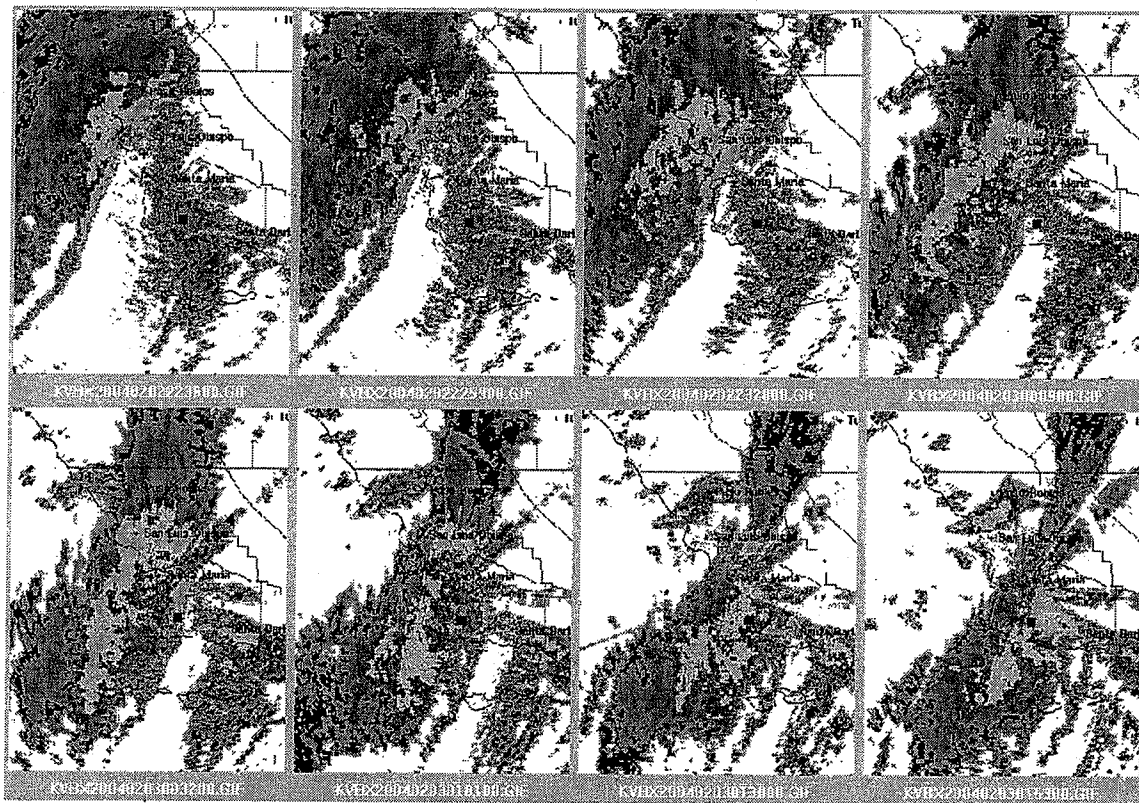
### Cost Estimates

The cost to conduct seeding operations is subject to a number of factors, including the duration of the operational period, the seeding mode(s) employed, staffing requirements, logistics, ease or difficulty of accessing ground seeding sites, insurance coverage, etc. The following cost estimates are based on fairly careful consideration of the various factors, so they provide reasonable guidance. A four-month operations period is assumed. Shorter duration operational periods will result in lower cost.

- A turn-key core seeding project using two AHOGS sites operated remotely by a meteorologist in Utah, for estimated average storm occurrence and seeding, for a four-month (December through March) period, including all costs for set-up, operations, expendables, end-of-season demobilization, and a project report, would be in the cost ballpark of \$150,000 per season. This is based on a generous estimate of seeding material usage.
- A turn-key four-month project using two AHOGS sites and one seeding aircraft, with a full-time meteorologist and dedicated pilot on-site, including all costs for set-up, operations, expendables, end-of-season demobilization; and a project report, would likely be in the cost range of \$275,000 to \$300,000 per season.

### Additional Considerations

- Suitable AHOGS sites would need to be identified. Forest Service lands are not good candidates.
- Environmental issues require attention, probably the performance of an Environmental Assessment to satisfy CEQA requirements.
- Publication of a Notice of Intent prior to conduct of operations is required.
- Criteria should be developed for suspension of seeding operations either temporarily (e.g., for severe weather or flood potential) or longer term (e.g., if water/aquifer conditions indicate that additional seeding is not desired for a period of time).
- It is helpful to view projects of this type in terms of benefit/cost, not just cost. Estimates of the additional rainfall can be converted to runoff by a hydrologist. The value of that water in the client's system can then be used in combination with the estimated seeding project cost to estimate the project benefit/cost ratio.
- The "core project" concept, where the least costly effective seeding mode is the core seed mode, lends itself well to incremental assessment of the value of project enhancements, such as secondary/supplemental seeding systems or specialty equipment systems. Using this concept, the project design offering the best value can be fairly readily identified. An example of the core concept applied to a seeding project design is summarized in Table 1, from a feasibility study recently conducted by NAWC for a mountainous region in western Wyoming. The numbers apply to the Wyoming project only.
- Experience is to weather modification as location is to real estate value.



**Figure 1. Convective band(s) passing over Santa Barbara County on February 2, 2004. Image times are 1436, 1459, 1528, 1609, 1632, 1701, 1730, and 1753 PST (from NAWC report on cloud seeding for SBA County).**

**TABLE 1**

**Estimated Costs to Produce Additional Water via Cloud Seeding  
And Estimated Attendant Benefit/Cost Ratios  
(an example from Salt River and Wyoming Ranges, Wyoming)**

	Core Program (CP)	CP Plus Remote CNG's	CP Plus Aircraft	CP Plus Remotes and Aircraft
Ave. Cost to Produce Extra Water	\$147,838	\$291,118	\$637,851	\$781,131
Ave. Water Year Streamflow Increase	77,468	90,398	96,643	109,573
Cost Per AF	\$1.91	\$3.22	\$6.60	\$7.13
Benefit	\$862,797	\$1,006,800	\$1,076,361	\$1,220,364
Benefit / Cost	5.8	3.5	1.7	1.6