The Simple Mapping Project (SMP)
A Proposal for the DSES

Submitted by Joseph DiVerdi

OBJECTIVES

1. To test the recently created radio data acquisition and upper dish position recording and reporting systems.
2. To develop experience in using the upper dish in extended and precision scientific measurements.
3. To begin the creation of a sky survey in support for subsequent pulsar exploration.

SPECIFIC GOALS

Phase 1: To generate position-limited integrated and frequency-disperse brightness maps of the sky from $0° \leq RA < 360°$ and $30° \leq Dec \leq 50°$ at 1420.406±1.0MHz.

Phase 2: To generate a position-limited brightness map of the sky from $0° \leq RA < 360°$ and $30° \leq Dec \leq 50°$ at 1421.406±1.0MHz.

DURATION

It is projected that it will require between twenty to thirty calendar days of dish time to accomplish each of the two Specific Goals identified above.

OVERALL STRATEGY

Meridian drift scans will be performed using the upper dish in no shorter than twenty-four (24) hour blocks while the automated, on-line, antenna position and radio receiver monitors collect data in real-time. The elevation will be systematically moved in 1° steps through the declination range +30° through +50°. This range corresponds to an elevation range of 90° through 80° and azimuth in the discrete values of 0° and 180°.

At least one continuous twenty-four hour scan will be collected at each 1° step in declination. Some scans will be repeated in order to assess the

magnitude and type of systematic and non-systematic errors in the entire data acquisition process.

The action of moving the upper dish will be performed manually by on-site personnel although the site (T22) will not be staffed continuously during each entire twenty-four hour data collection period. In other words, the upper dish will be maintained in a non-stowed position while the site is unoccupied. To accomplish the upper dish position objectives outlined in this work the dish will never be more than 10° from the stow position.

The requirement that the dish be maintained in a particular declination position for at least twenty-four hours will ensure that a complete "ring" of sky will be observed in each scan. This will facilitate subsequent data processing. The position of the upper dish, including the motion from one elevation to another, will be recorded by the on-line dish position monitor. The individual performing the upper dish position change will make an entry in a web-based log. This will permit remote monitoring of these actions.

At no time will the upper dish motor power be left on while T22 is unoccupied.

RATIONALE

The proposed work is important for several reasons. (1) From an organizational perspective it provides a Project with a well-defined and achievable set of goals with useful deliverables. (2) Its execution and completion will provide the Project Participants (drawn from the DSES membership) with an externally recognizable and demonstrable skill set. (3) It will serve as a useful test in the individual and integrated operation of several important observing systems including upper dish position monitoring, radio science data, anemometry, and operational coordination. (4) It will generate scientifically interesting data obtained by the DSES operating at Table Mountain that was heretofore obtainable (qualitatively and quantitatively) at professional institutions. (5) It will provide preliminary and detailed data that will be used in future observations of pulsars and other phenomena.

REQUIRED COLLABORATION

Given the extended nature of the data collection process and the need for the upper dish to be moved manually once each twenty-four hour period it will be necessary to recruit a number of qualified individuals who live and/or work in sufficient proximity to Table Mountain to (1) make the periodic movements, and (2) be "on call" to address "need-to-stow" situations. In

general, each change in upper dish elevation is expected to require no more than twenty (20) minutes on-site. Contact information will be prepared for all individuals involved in this project, together with movement and on-call schedules for them.

RISKS

The sole risk specific to this proposed Project is damage to the upper dish structure from the combination of high wind at the site together with the dish in a non-stowed position. This risk is mitigated by the intentionally limiting the range of upper dish position required by this work. Additionally, real-time, on-line monitoring of the local wind speed will provide a quantitative measure against which a series of "need-to-stow" decision can be made. In such an event, one of the "on-call" individuals would be required to manually stow the upper dish.

There are no other risks of damage to any equipment specific to the work proposed in this Project. There are no risks to any personnel involved in this work that are specific to work proposed in this Project.

USES AND OWNERSHIP OF ACQUIRED DATA AND DERIVED RESULTS

The raw acquired data and preliminary graphs of it will be continuously available for unrestricted viewing during the data collection period via a World Wide Web interface although the location of this information will not be generally publicized without prior agreement of the Project Leader and Participants and the DSES Board. This data will be continuously monitored and periodically studied in detail for sources of system errors (systematic and non-systematic data acquisition and/or positioning). Sky maps will be created from this data which will be available for publishing on the DSES web site, printed literature, for presentation by DSES members, and other external communications media as decided by the DSES Board. Copyright of the entire body of collected data will be transferred to the DSES with a non-exclusive, irrevocable right to publish the same body retained by XTR Systems, LLC.

CONDITIONS REQUIRING STOW

The addition of a real-time, on-line anemometer to the equipment at T22 provides a readily accessible and constant-on monitor of the environmental parameter most critical to the safety of the upper dish. The current and historical wind speed can be easily found using a World Wide Web browser.

The definition of wind speed that will require immediate stowing of the upper dish is a requirement of this proposed Project. In the creation of such a definition a detailed aerodynamic model (of the type recently discussed with University of Colorado faculty) would be of great assistance. In lieu of such a model, empirical experience of DSES personnel with the upper dish will be used to create the definition. As a consequence, it is certain that a definition will be created which is overly conservative. The consequences of this conservative choice would be the lengthening of the data collection period as the upper dish would be stowed more often.

The following wind speed conditions requiring stow are proposed:

1. For dish elevation of 85° to 89° the dish would be stowed (raised to 90°) if the ten-second-average wind speed exceeds 40MPH or if there is a gust exceeding 50MPH in any ten-second period.
2. For dish elevation of 80° to 84° the dish would be raised to the 85° to 89° range if the ten-second-average wind speed exceeds 30MPH or if there is a gust exceeding 40MPH in any ten-second period.
3. The dish could be moved away from stow into the elevation ranges identified above only if the stow condition which requires movement from a particular range and towards stow was not observed for thirty (30) minutes.

OTHER CONSIDERATIONS

The data collection and antenna position monitoring systems are maintained on an Uninterruptable Power Supply (UPS) system which will maintain their operation for a limited amount of time during a main power outage. Normal operations will prevail during such conditions.

In the event that main power has been interrupted for a period of time exceeding the capacity of the UPS system, the acquisition and monitoring systems will shutdown. The data collection and antenna position monitoring systems have been designed to be “self-healing”, that is, they will recover automatically and resume normal operation when main power is recovered.

There remains the possibility that main power would be interrupted while the dish is unstowed and the wind speed exceeds the defined threshold for the dish elevation. The lack of electrical power would prevent stowing the dish by any other than a manual, mechanical process executed by an individual in the tower.