SKA Five-Year Plan Discussion Summary

Peter J Hall, 31 August 2000

Background

There were several themes to emerge from the discussions; most of these flow from the need to define a realistic scope and timescale for the SKA, and to forge more effective international collaboration. The recommendations from the discussion group were practical ones and relate principally to the formation of an Engineering and Management Team (EMT), a first-pass at identifying synergies between SKA groups, drafting of an initial time-line for the project, and the formation of a "definitions" group (working under the auspices of the EMT) to standardize terminology and specifications. The recommendations are presented in the appendices; the summary below deals with some the related issues which arose during discussion.

Summary of Major Discussion Points

Science - Engineering Interaction
It was recognized that the project needs mechanisms for promoting iteration between science and engineering groups. The establishment of the EMT and the complementary Science Advisory Committee (SAC), both working under the International SKA Steering Committee (ISSC), should provide a mechanism for at least the formal interaction.

System Definition (or Technical Overview) Document
The SKA project currently lacks a technical overview document to complement the science case. An evolving document, containing agreed definitions and goals, is essential not only to our own SKA community but also to specialist engineers recruited to particular SKA-related investigations. Production of such a document is clearly a priority for the EMT.

Synergies
There is considerable scope for international collaboration in the technical and system engineering areas. For example, Canadian and Chinese large active reflector concepts face similar challenges, while US, Dutch and Australian concepts have many areas of overlap. Identification of the synergies is the first step and recommendations for collaborative ventures should flow from the EMT to the ISSC.

Scaling
A number of participants felt that we need to think more about what constitutes viable demonstrators of concept. The leap of faith from the demonstrator to the SKA should not be unreasonable and one aim of the EMT (flowing from its role in framing recommendations for collaborations) might be to assist in the definition of adequate demonstration systems.

Auditing and Reporting
There is a need for the EMT to establish initially the state of the various national projects and to brief the ISSC on the progress of individual groups. The progress should be measured against milestones agreed nationally and internationally.

Project Evaluation
It is important that the scope of the SKA project be realistic and that individual concepts be evaluated against continuously-updated specifications. The EMT properly has the major role in this evaluation but participants noted that the need for intellectual honesty is paramount; the EMT is not a forum for national (or concept) advocacy.

Timescale
There was some debate about whether a 2005 technology decision was feasible. On balance, it seems dangerous to arbitrarily extend the deadline at this stage although, with the EMT in operation and the emergence of strawman SKA designs, there may be a case for defining an additional level of demonstrator between those presently envisaged and the actual SKA. Conceivably, such a post-2005 demonstrator could itself be an international project and might even be part of the final instrument. In keeping with the wish to keep the project moving as fast as possible, a timeline based on the 2005 date was produced; it is included as Appendix 2.

Appendix 1 - The SKA Engineering and Management Team

Peter Hall, 5 August 2000

We recommend the formation of a small, internationally-constituted, group to oversee technical and planning aspects of the SKA project. The preferred title of the group is the "Engineering and Management Team" (EMT). The EMT would report to the ISSC and would also have close, regular, interactions with the proposed Scientific Advisory Committee.

In summary, the model we envisage involves a small Team which oversees and co-ordinates the activities of a number of specialist working groups, including a group dealing with system engineering aspects of the SKA. We note at the outset that it is highly desirable that any structure imposed now lead naturally to a realistic SKA project management tree. One option might be to have the Project Manager as Chair of the EMT; other options involve a completely external management team reporting directly to the ISSC, with the EMT maintaining an engineering science advisory role.

In more detail, we recommend that the main immediate functions of the EMT be to:

(a) conduct a technical audit of the existing SKA technical activities and present the summary to the ISSC;

(b) highlight synergies between the efforts of various groups and recommend possible collaboration groupings to ISSC;

(c) identify important deficiencies and pressing technical or system engineering needs in the international SKA effort;

(d) recommend to the ISSC the formation of specialist engineering science and planning task forces and, when these bodies are operational, act in information gathering, distillation and reporting roles;

(e) create and maintain an evolving SKA system definition document, updated annually, and containing at least

(i) agreed goals and definitions,
(ii) a composite timeline showing major project milestones,
(ii) project reports from various international groups,
(iii) appraisals of various project outcomes, with particular emphasis on the assessment of whether previously-agreed milestones remain realistic,
(iv) a summary of major technology breakpoints, and advice to the ISSC concerning the realism of the demanded scope of the SKA project,
(v) commentary on the operational viability of existing or new concepts,
(vi) an executive summary forming the core of a formal annual report to the ISSC;

(f) foster the flow of information between international project groups, and between the science and engineering communities, by means of a formal SKA technical memo series (to be maintained in parallel with the scientific memos likely to be generated by the Scientific Advisory Committee);

(g) work with the Scientific Advisory Committee towards identifying and resolving issues in which critical science goals and engineering constraints interact.

Some points to be borne in mind when constituting the EMT include:

(a) the Team should not be too large (perhaps four people, including one systems engineer), but should adequately understand the range of SKA concepts in the development arena (a representative of each major concept may be a realistic aim);

(b) given the need for intellectually honest appraisals of projects, it is obvious that members will be expected to demonstrate impartiality, not simply act as advocates of particular concepts;

(c) the resources necessary to run the EMT should not be under-estimated - very likely the load on members will form the majority of their work commitments and, with 6-monthly face-to-face meetings being considered the minimum, the actual operating expenses will not be negligible;

(d) the resources challenge is even greater if likely downstream EMT recommendations to engage specialist consultants (e.g. system engineers, project managers) are approved by the ISSC.

Appendix 2 - Draft SKA Timeline

Bob Preston, 30 August 2000

The accompanying diagram shows a draft timeline of milestones for the development of the SKA. Although this first outline of a path to convergence is very sketchy, it does provide a focus for discussion and debate on this issue. This rough plan was developed by a combination of two working groups at the Jodrell Bank meeting, and was discussed by the International SKA Steering Committee.

The timeline has two separate horizontal paths, one for the design choice and one for the choice of a site location. The horizontal axis is an approximate (but not linear) measure of time. Items in rectangles indicate major milestones while items in ovals indicate input needed to achieve those milestones. Neither preliminary milestones or feedback loops are shown in this diagram to reduce visual clutter, but it is recognized that both are needed.

At the bottom is a list of groups needed to perform the tasks shown. Note that this initial plan does not indicate the processes by which these various milestones are accomplished. No specification is made of which group is involved in each task or how the groups are related to each other; these are the subjects of an ongoing action item of the ISSC.

The timeline is driven by a desire to choose an SKA design and site within 5 years (i.e., by mid-2005). The justification for selecting 5 years for SKA development is that this would allow some time for technologies to mature as well as match the anticipated beginning of possible funding wedges. However, the choice of 5 years is somewhat arbitrary, and the timeline could prove overoptimistic.

The SKA Design Choice Timeline

The timeline specifies that the SKA design will be chosen in August 2005. This means that the number of design and technology options presently being considered must be narrowed at an earlier time to a few (say 1 to 3) "strawman" SKA concepts that are then studied in some detail. This "down-select" is shown to occur two years before the design is finalized, or in August 2003. In order to prepare for this choice of strawman concepts, two separate paths of milestones are displayed. The upper path deals with refining technology concepts, and includes an independent review of each present technology concept (January 2002) and the definition of the guidelines by which strawman design choices will be made (August 2002). The lower path deals with developing more detailed science requirements and includes prioritization of science goals (January 2002) and definition of more detailed design requirements (August 2002) with specification of "breakpoints" in science return to aid designers.

The SKA Site Selection Choice Timeline

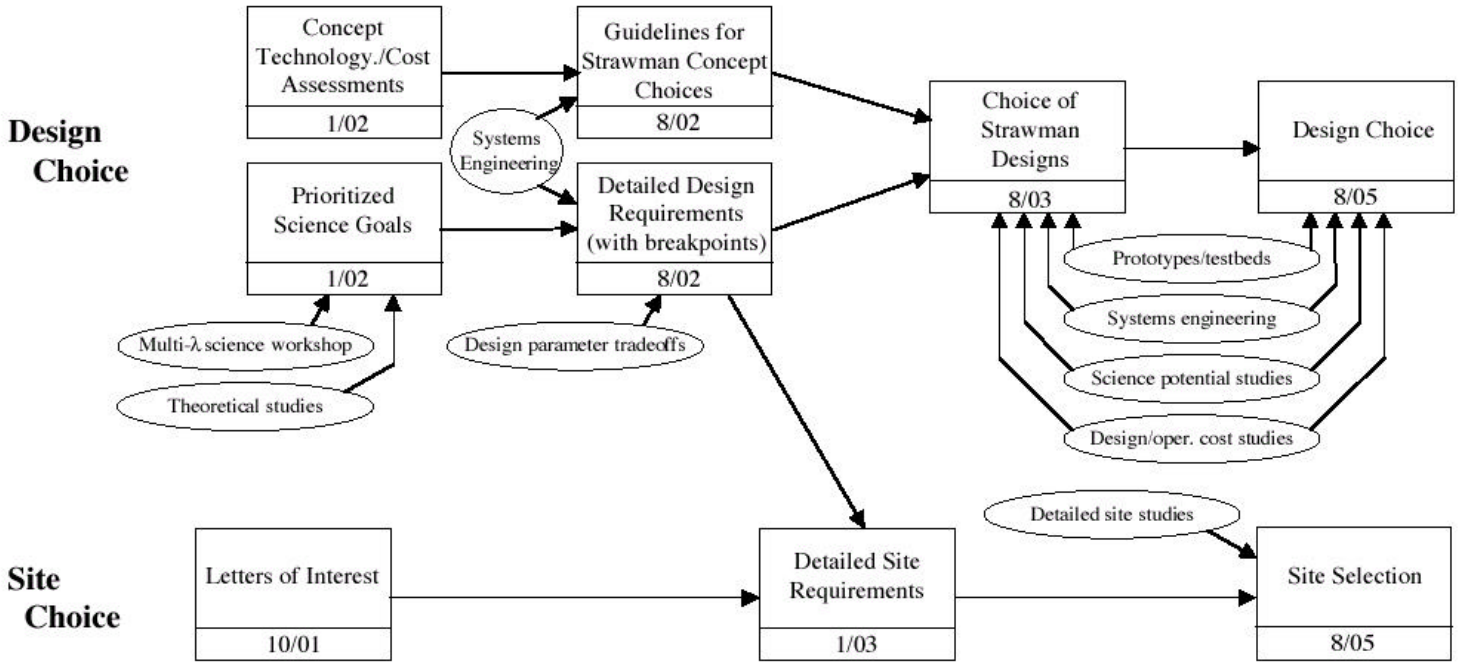
The timeline specifies that the SKA site will be chosen in August 2005. This date is concurrent with the choice of the SKA design since these two choices may not be independent. Letters of interest for hosting the SKA would be due by October 2001 to clarify what sites should be under serious consideration. Detailed site requirements, partially based on the new detailed SKA design requirements described above, would be specified by January 2003 to allow adequate time for intensive site studies before the August 2005 decision date.

Draft Timeline for SKA Design

□ = Milestone (preliminary versions of each milestone are not shown)

⬭ = Input to milestone

Note: Feedback loops are not shown



Groups Needed

- International SKA Steering Committee
- Project Manager/Engineer
- Engineering and Management Team (includes system engineering)
- Site Selection Committee
- Simulation Groups
- Science Working Group
- Theorists
- Outreach Group

Appendix 3 - First-Pass Synergy Analysis

Michiel van Haarlem, 5 August 2000

Identification of areas of synergy

a. between different groups
b. between different concepts

Potential Areas of Common Interest:

1. Focal plane arrays
2. Single feeds
3. Structural Engineering (e.g. actuators)
4. Monitoring and Control (software)
5. Cryogenics
6. LNA design and development
7. Configuration studies
8. DSP Correlator/Beamforming
9. Communications
10. RFI
11. System Engineering
12. Site/Fixed costs/infrastructure

Description of Categories for Matrix:

- Have capability: +/++
- Have knowledge/no resources: –
- Need to know: ?
- Don't Care: <blank>

	Focal Plane Arrays	Single Feeds	Structural Engineering	Monitoring and Control	Cryogenics	LNA's	Configuration studies	DSP correlator/Beamfo	Communications	RFI	System Engineering	Site/Fixed Costs/Infrastructur	
Australia													
ASTRON													
China													
Canada													
UK													
JPL													
SETI/Berkeley													
MIT/Haystack													
NRAO													
India													

List of Concepts:

1. FAST
2. Luneburg Lens
3. Phased Arrays
4. LAR
5. Small Dishes

A similar matrix can be made of Concepts vs. Areas of Common interest.

Appendix 4 - Definitions Working Group

It was agreed to convene an EMT working group, under the chairmanship of Peter Dewdney, to define clearly SKA parameters and goals. Each group country will nominate a representative to the working group.