VLA Scientific Memo #168

A proposal for a new sequence of VLA configurations

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Motivation

The current sequence of configurations moves the array from the largest to the smallest configuration stepping by one configuration at a time and at the end of the process, skips again to the largest one. Hybrid configurations are smoothly interspersed and the whole cycle lasts 16 months which allows for a slow rotation of the configurations with the seasons.

The two all-sky surveys currently in progress have severely strained this scheme. Two arrays (B,D) have been lenghtened while the other two (A,C) have been seriously shortened. In addition, the constraint to keep the full cycle to a total time of 16 months is displacing a large number of good proposals which might cause some long-term damage as researchers might not get their grants renewed as they cannot deliver their proposed research.

In addition, it would seem desirable to reverse the sense in which the cycle is followed as it is often necessary to obtain low-resolution data before deciding whether higher-resolution observations are necessary, and what objects out of a list of targets should be observed for what integration time. Proposers would write their observing requests for perhaps all four configurations with their "best estimates" of observing time. As the data are reduced, a note to the allocation committee describing results "in progress" would suffice to fine-tune the request.

If we decided to reverse the order in which the configurations are covered, we could relax the "16 month" rule and therefore minimize the damage that the current surveys are inflicting on other proposals by lengthening the configurations as needed. It is still important to avoid "resonances" that might not rotate the times at which some objects would be observable (for example the reconfiguration schedule should not move objects from one twilight to the other the next time around, so half-year resonances should be avoided).

Any change on a schedule advertised in advanced as is ours can have bad implications on the science that our users plan. In the past, we have shown enough flexibility to, for example, send 6 antennas to stations A7 and A9 of each arm to respond to a time-critical experiment that required the highest resolution. I believe that we could still do this if the scientific needs of a highly-ranked proposal required it. Therefore, no serious damage should result from the change proposed below. In any case, an important, variable object might

require such change even with the current scheme.

Other possibilities can also be considered. For example the sequence A-B-C-D-C-B-A-B-C-D with longer periods in A and D avoids the long D to A or A to D moves but seems undesirable for a couple of reasons: it imposes a jitter in the times of transit of objects with reconfigurations and resonances might be hard to avoid, it spends half its time "going the wrong way" and, in addition, the "long moves" have been profitably used in the past as they have allowed monitoring of variable objects, observations of stars and other projects whose complexity in scheduling would have made them hard to accomodate in the proper configurations.

Proposed schedule for the next few years:

What follows is only a bit more elaborated that a scheme. I have used the current schedule for comparison. I have also included the constraint that no gross change can be made until a full cycle of the current scheme to avoid "pulling the rug" on our users who might have plans for the currently advertised sequence. So all configuration should come up for proposal before the sequence is altered, but I believe that a slippage of a few months is not too damaging.

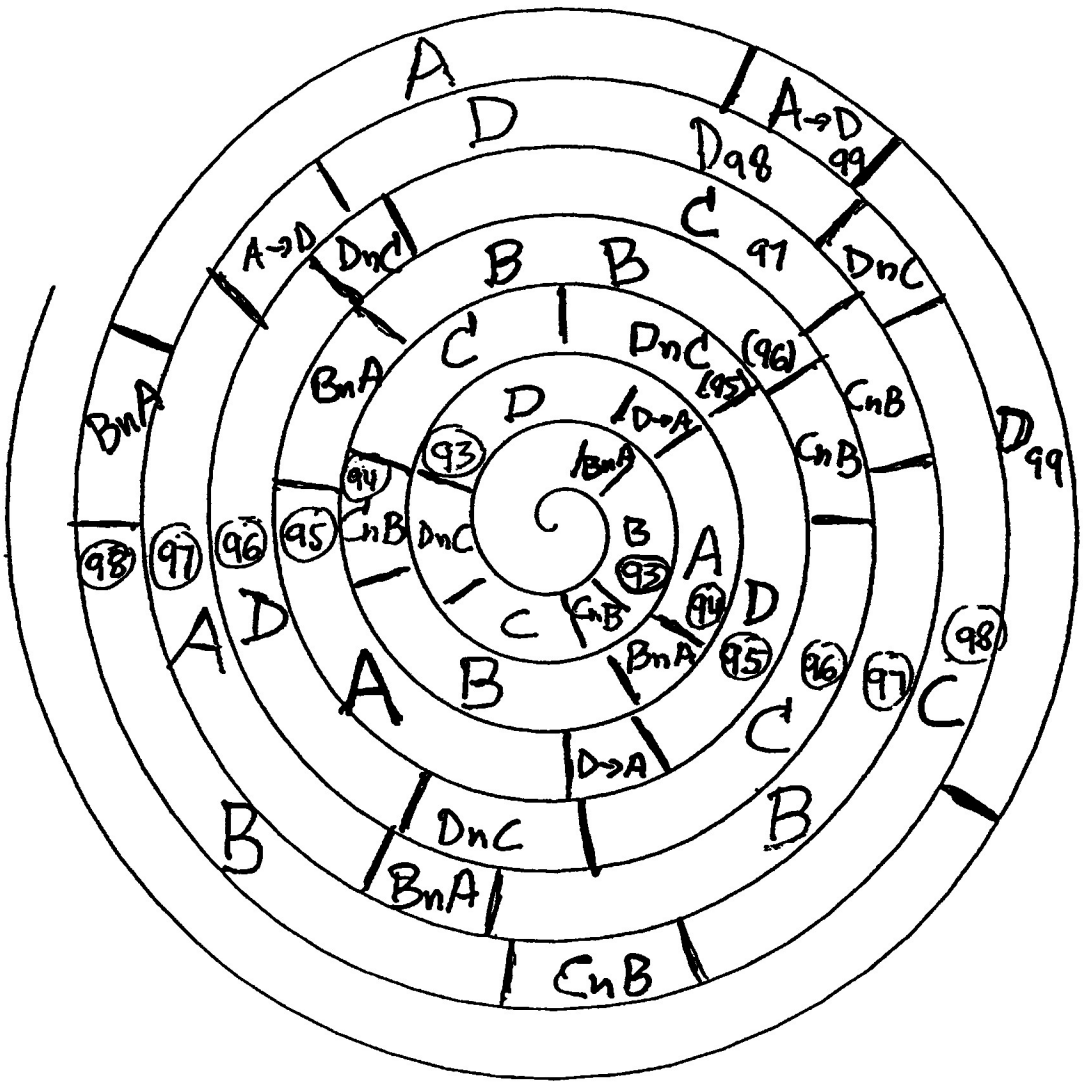
The proposed scheme "bounces" back on the second D-array in order to (1) allow all configurations to come up for proposals before the change and (2) have no impact on the D-array survey which will be finished with the configuration on which the bounce occurs. The D-array users will see no change in the sequence of this configuration. The B-array will also rotate through the seasons smoothly as if no change had taken place. Thus, the only change to these configurations will be a slight lengthening to alleviate the current squeeze imposed by the surveys.

The C-array will skip its occurrence in the Fall, which might prevent the observation of some objects at nighttime for some years. However, this is not too damaging as we are approaching solar minimum and day-time observations are not too much of a problem. By far, the worse conflict arises with the A-array which (1) will take almost two years to come back because of the bounce being made in the D-array, and (2) will then come back at the same time of the year. However, this will occur in the late Summer and Fall and could be slipped further by a few months in order to avoid the tail of the Summer.

The choice is obviously one between two different problems. The de-synchronization of the configuration with the past scheme does seem to be the least painful one to swallow as it minimizes the pain inflicted by the surveys and allows us to describe the cycle of configurations in a somewhat more convenient way. In any case, by 1999 the pain will have subsided entirely!

First option

Present Configuration	Present Dates	Proposed Configuration	Proposed Dates
BnA	5/13/94 - 5/30/94	BnA (2)	5/13/94 - /5/30/94
B	6/3/94 - 9/5/94	B (15)	6/3/94 - 9/19/94
CnB	9/16/94 - 10/3/94	CnB (2)	9/30/94 - 10/17/94
C	10/7/94 - 12/12/94	C (10)	10/21/94 - 1/2/95
DnC	12/16/94 - 1/9/95	DnC (6)	1/13/95 - 2/27/95
D	1/13/95 - 5/1/95	D (13)	3/3/95 - 6/5/95
A	5/26/95 - 7/31/95	A (14)	6/30/95 - 10/9/95
BnA	8/11/95 - 8/28/95	BnA (3)	10/20/95 - 11/13/95
B	9/1/95 - 12/4/95	B (15)	11/17/95 - 3/4/96
CnB	12/15/95 - 1/2/96	CnB (2)	3/15/96 - 4/1/96
C	1/5/96 - 3/11/96	C (10)	4/5/96 - 6/17/96
DnC	3/22/96 - 4/15/96	DnC (4)	6/28/96 - 7/29/96
D	4/19/96 - 7/29/96	D (14)	8/2/96 - 11/11/96
A	8/23/96 - 10/28/96	DnC (2)	11/15/96 - 12/2/96
BnA	11/22/96 - 12/9/96	C (10)	12/13/96 - 2/24/97
B	12/13/96 - 3/17/97	CnB (2)	2/28/97 - 3/17/97
CnB	3/28/97 - 4/14/97	B (15)	3/28/97 - 7/14/97
C	4/18/97 - 6/23/97	BnA (2)	7/18/97 - 8/4/97
DnC	7/4/97 - 7/28/97	A (10)	8/15/97 - 10/27/97
D	8/1/97 - 11/17/97	D (12)	11/21/97 - 2/16/98
A	12/12/97 - 2/16/98	DnC (2)	2/20/98 - 3/9/98
BnA	2/27/98 - 3/16/98	C (12)	3/20/98 - 6/15/98
B	3/20/98 - 6/1/98	CnB (2)	6/19/98 - 7/6/98
CnB	6/12/98 - 6/29/98	B (10)	7/17/98 - 9/28/98
C	7/3/98 - 9/28/98	BnA (2)	10/2/98 - 10/19/98
DnC	10/9/98 - 10/26/98	A (12)	10/30/98 - 1/25/99



1/1 2/1 12/1 11/1 10/1 9/1 8/1 7/1 6/1 5

93 B96
A94 C97
A95 D98
D99

Second option

Present Configuration	Present Dates	Proposed Configuration	Proposed Dates
BnA	5/13/94 - 5/30/94	BnA (2)	5/13/94 - /5/30/94
B	6/3/94 - 9/5/94	B (15)	6/3/94 - 9/19/94
CnB	9/16/94 - 10/3/94	CnB (3)	9/30/94 - 10/24/94
C	10/7/94 - 12/12/94	C (12)	10/28/94 - 1/23/95
DnC	12/16/94 - 1/9/95	DnC (4)	2/3/95 - 3/6/95
D-	1/13/95 - 5/1/95	D (17)	3/3/95 - 7/5/95
A	5/26/95 - 7/31/95	A (12)	7/31/95 - 10/23/95
BnA	8/11/95 - 8/28/95	BnA (3)	11/3/95 - 11/27/95
B	9/1/95 - 12/4/95	B (16)	12/1/95 - 3/25/96
CnB	12/15/95 - 1/2/96	CnB (3)	4/5/96 - 4/29/96
C	1/5/96 - 3/11/96	C (13)	5/3/96 - 8/5/96
DnC	3/22/96 - 4/15/96	DnC (4)	8/16/96 - 9/16/96
D	4/19/96 - 7/29/96	D (15) (skip survey)	9/20/96 - 1/6/96
A	8/23/96 - 10/28/96	A (15)	1/31/97 - 5/19/97
BnA	11/22/96 - 12/9/96	BnA (3)	5/30/97 - 6/23/97
B	12/13/96 - 3/17/97	B (17)	6/27/97 - 10/27/97
CnB	3/28/97 - 4/14/97	CnB (3)	11/7/97 - 12/1/97
C	4/18/97 - 6/23/97	C (12)	12/5/97 - 3/2/98
DnC	7/4/97 - 7/28/97	DnC (4)	3/13/98 - 4/13/98
D	8/1/97 - 11/17/97	D (18) (end survey)	4/17/98 - 8/24/98
A	12/12/97 - 2/16/98	A (12)	9/18/98 - 12/14/98
BnA	2/27/98 - 3/16/98	BnA (3)	12/24/98 - 1/18/99
B	3/20/98 - 6/1/98	B (16)	1/22/99 - 5/17/99
CnB	6/12/98 - 6/29/98	CnB (3)	5/28/99 - 6/21/99
C	7/3/98 - 9/28/98	C (12)	6/25/99 - 9/20/99
DnC	10/9/98 - 10/26/98	DnC (3)	10/1/99 - 10/25/99

An alternative suggestion: Lengthening the cycle

Barry Clark has suggested that the short-term pain might be alleviated by adding enough observing time to the present sequence of configurations. In particular, adding four months to every cycle allows enough time and provides again for a smooth slide of the configurations with the seasons. The sense of the drift would be reversed from the present one. Indeed, a configuration would come up again after 20 months, four months earlier (in the second year). The change in the sense of the drift would produce a perturbation like the one seen as a disadvantage in the previous proposal. The perturbation would affect many more projects as the drift of all array configurations would be reversed. In addition, the total time required to complete a full sequence would increase from five years to seven years, which might be too long for some (thesis) projects. However, the extra month available to each configuration would likely be useful in the long term as it might allow the scheduling of occasional large projects (after the completion of the surveys) with less pain than the current shorter schedule would inflict.

The following table implements this option. I have not drawn a corresponding spiral diagram as all configurations slide in the reverse order from what they have followed in the past.

This option forces a severe modification of the D-array survey as the (nominal) third part of the survey has to be postponed by two years because the altered rotation puts the third D-array at the same time of the year as the first one was. After skipping this one, the fourth D-array of the survey era falls at the right time and is long enough to allow completion of the D-array survey. The third one can be use to fill in holes which should not require too much time so I have not made this one as long as the other ones in the implementation that I show in the table.

Third option

Present Configuration	Present Dates	Proposed Configuration	Proposed Dates
BnA	5/13/94 - 5/30/94	BnA (2)	5/13/94 - /5/30/94
B	6/3/94 - 9/5/94	B (15) (B survey)	6/3/94 - 9/19/94
CnB	9/16/94 - 10/3/94	CnB (2)	9/30/94 - 10/17/94
C	10/7/94 - 12/12/94	C (10)	10/21/94 - 1/02/95
DnC	12/16/94 - 1/9/95	DnC (6)	1/13/95 - 2/27/95
D	1/13/95 - 5/1/95	D (13) (D survey)	3/3/95 - 6/5/95
A	5/26/95 - 7/31/95	A (14)	6/30/95 - 10/09/95
BnA	8/11/95 - 8/28/95	BnA (3)	10/20/95 - 11/13/95
B	9/1/95 - 12/4/95	B (15) (bounce, survey)	11/17/95 - 3/04/96
CnB	12/15/95 - 1/2/96	BnA (3)	3/8/96 - 4/1/96
C	1/5/96 - 3/11/96	A (12)	4/12/96 - 7/8/96
DnC	3/22/96 - 4/15/96	D (15) (final D survey)	8/2/96 - 11/18/96
D	4/19/96 - 7/29/96	DnC (3)	11/22/96 - 12/16/96
A	8/23/96 - 10/28/96	C (12)	12/27/96 - 3/24/97
BnA	11/22/96 - 12/9/96	CnB (3)	3/28/97 - 4/21/97
B	12/13/96 - 3/17/97	B (16) (B survey)	5/2/97 - 8/25/97
CnB	3/28/97 - 4/14/97	BnA (3)	8/29/97 - 9/22/97
C	4/18/97 - 6/23/97	A (14)	10/3/97 - 1/12/98
DnC	7/4/97 - 7/28/97	D (15)	2/6/98 - 5/25/98
D	8/1/97 - 11/17/97	DnC (3)	5/29/98 - 6/22/98
A	12/12/97 - 2/16/98	C (13)	7/2/98 - 10/5/98
BnA	2/27/98 - 3/16/98	CnB (3)	10/9/98 - 11/2/98
B	3/20/98 - 6/1/98	B (16) (survey?)	11/13/98 - 3/8/99
CnB	6/12/98 - 6/29/98	BnA (3)	3/12/99 - 4/5/99
C	7/3/98 - 9/28/98	A (14)	4/16/99 - 7/26/99
DnC	10/9/98 - 10/26/98	D (15)	8/20/99 - 12/6/99

A second alternative: Reversing the order and lengthening the cycle

Another possibility is to reverse the sequence of configurations as well as lengthening the cycle to twenty months. As with the previous option, the sense of the drift would be reversed from the present one and the rest of the changes would also occur: a configuration would come up again after 20 months, four months earlier (in the second year) and again it would take seven years to complete a full sequence.

The following table implements this option. The worst perturbation is felt in the C array which takes two years to return and then does so in the same season.