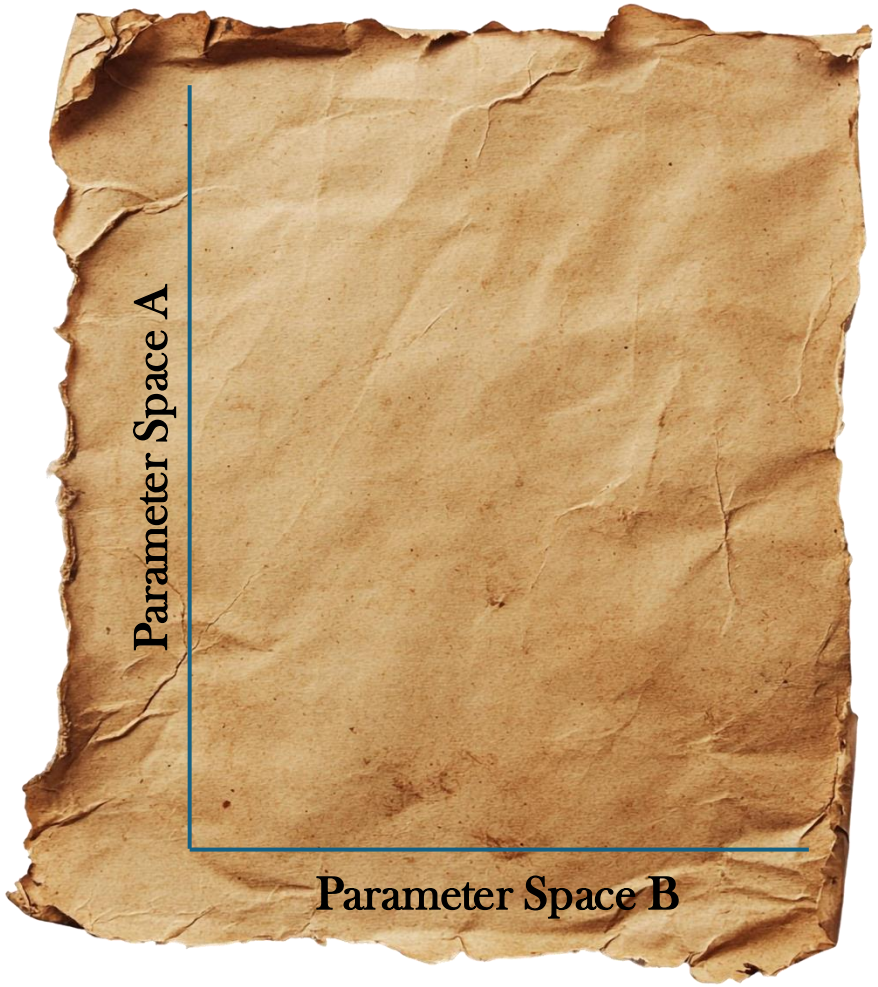
New dishes in the West

George Hobbs
(this is George as an individual scientist)

The comments here do not reflect ATNF leadership views!

Warning: speculative content. No management sign-off detected.
These ideas have not been stress-tested against reality or policy.

ATNF2030 is all about parameter space, SKA capabilities and likely budgets/funding



Parameter space is multi-dimensional.

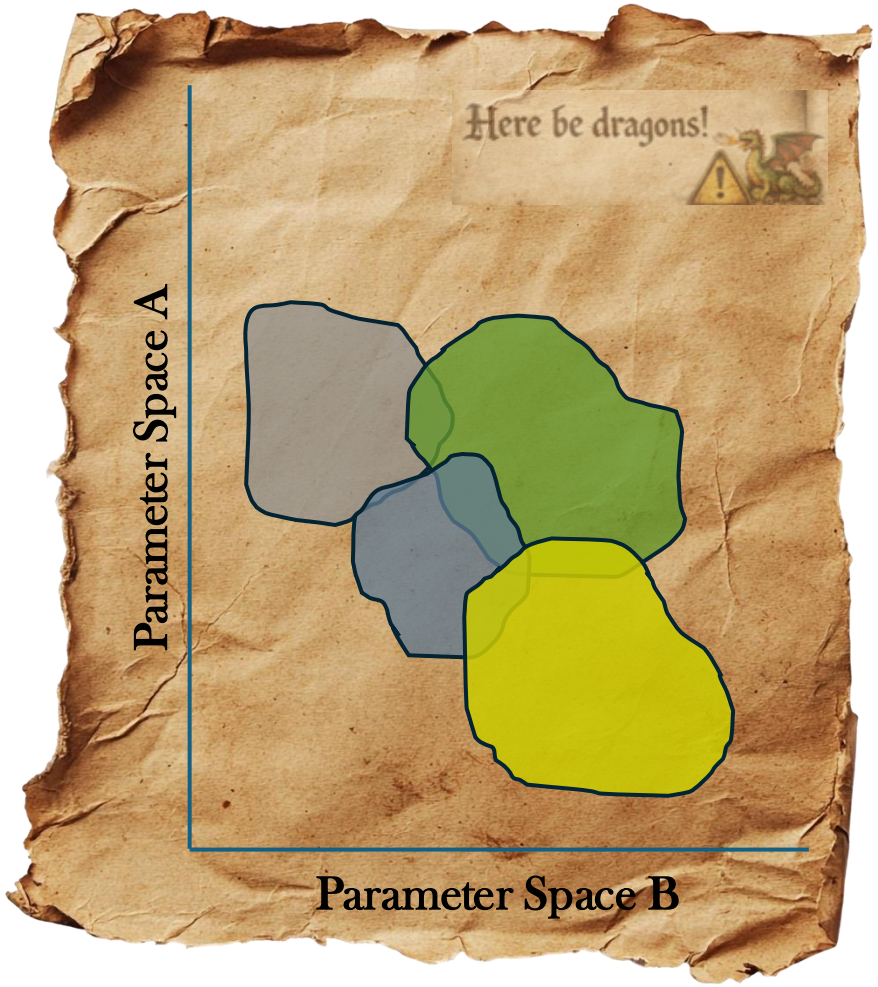
Includes parameters like:

- Frequency coverage, field of view, declination limits etc.

As well as

- Availability of telescope time, who has access, rapid response capabilities, science-ready data products etc.

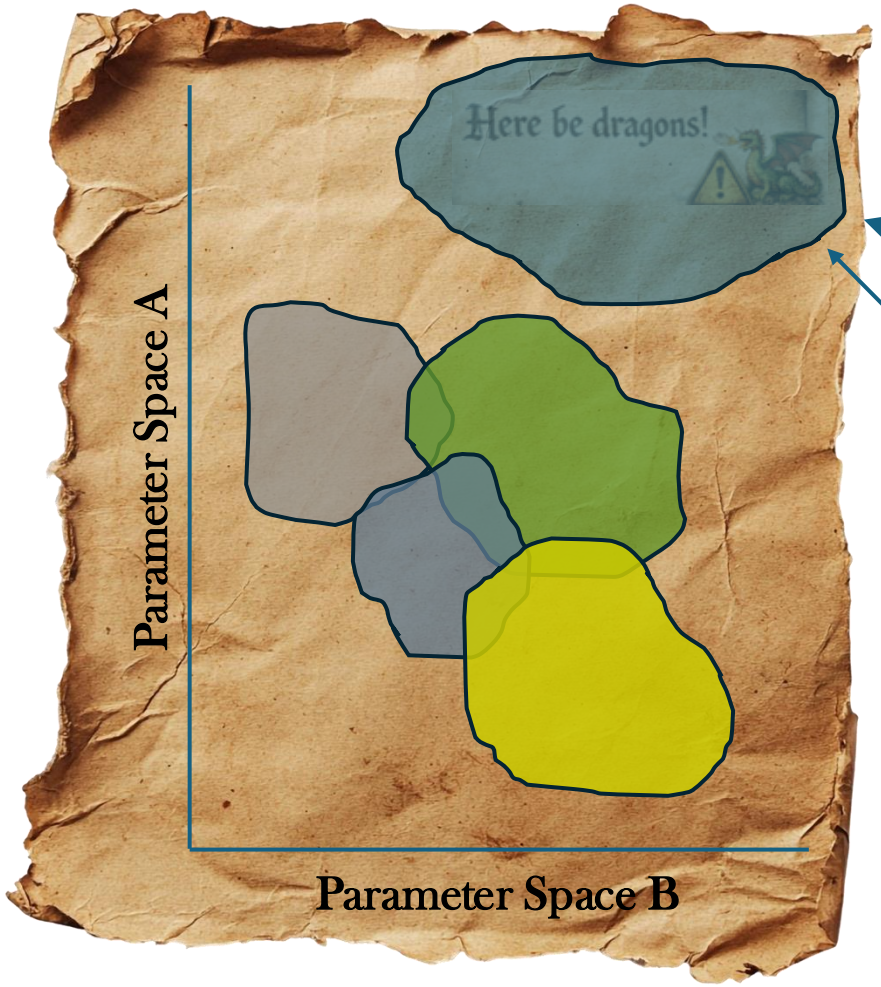
Our existing facilities are (mostly) complementary



- Colours here represent Murriyang, ATCA, ASKAP and LBA.
- Note some overlaps, but plenty of parameter space only covered by a specific facility.
- Of course, parameter space is enormous and so our existing facilities do not cover it all.

- Increasing RFI means that this parameter space is decreasing for existing facilities (in particular for East-Coast facilities).

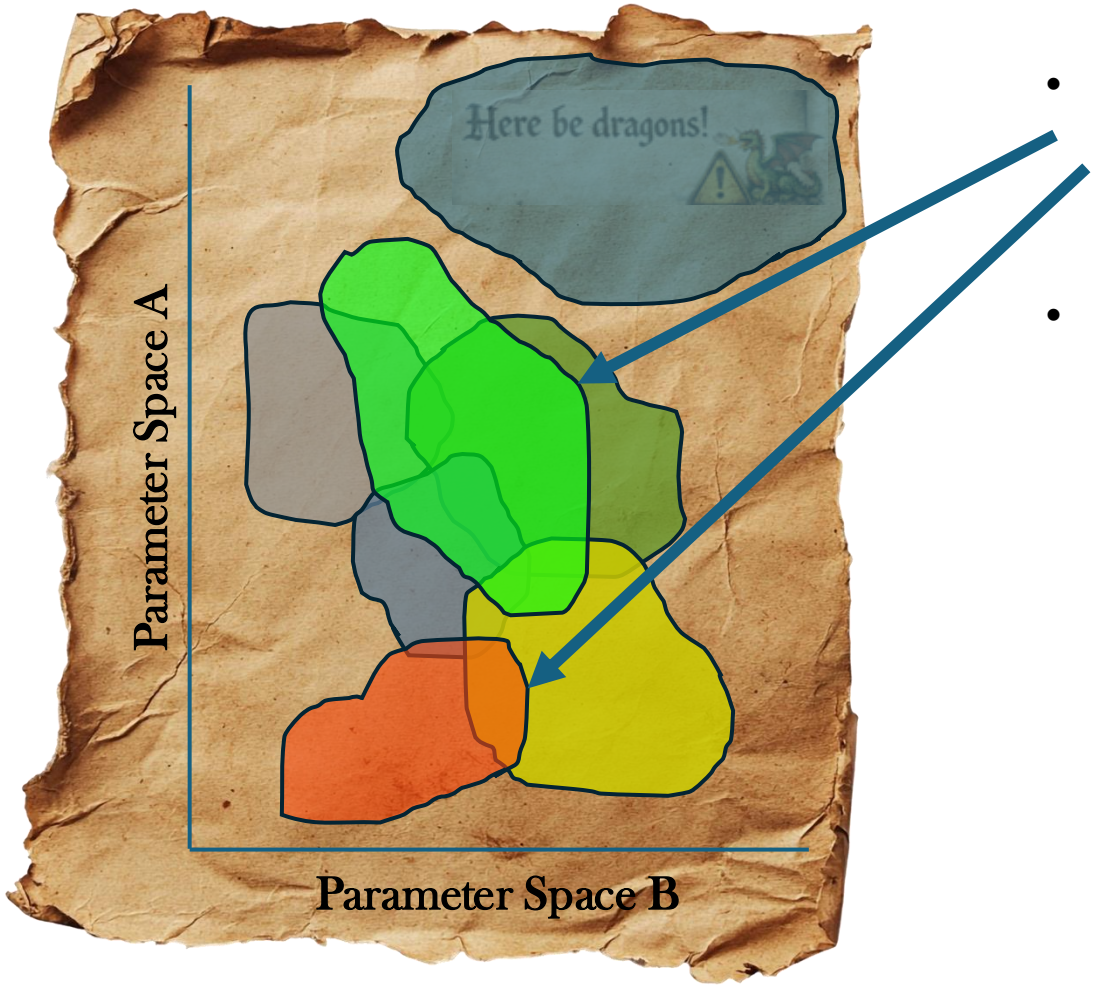
As a scientist what do I want?



- Discovery comes from opening new parameter space.
- **Science view** – develop a new facility that covers as much of the unexplored parameter space as possible
  - (e.g., CASATTA-style)

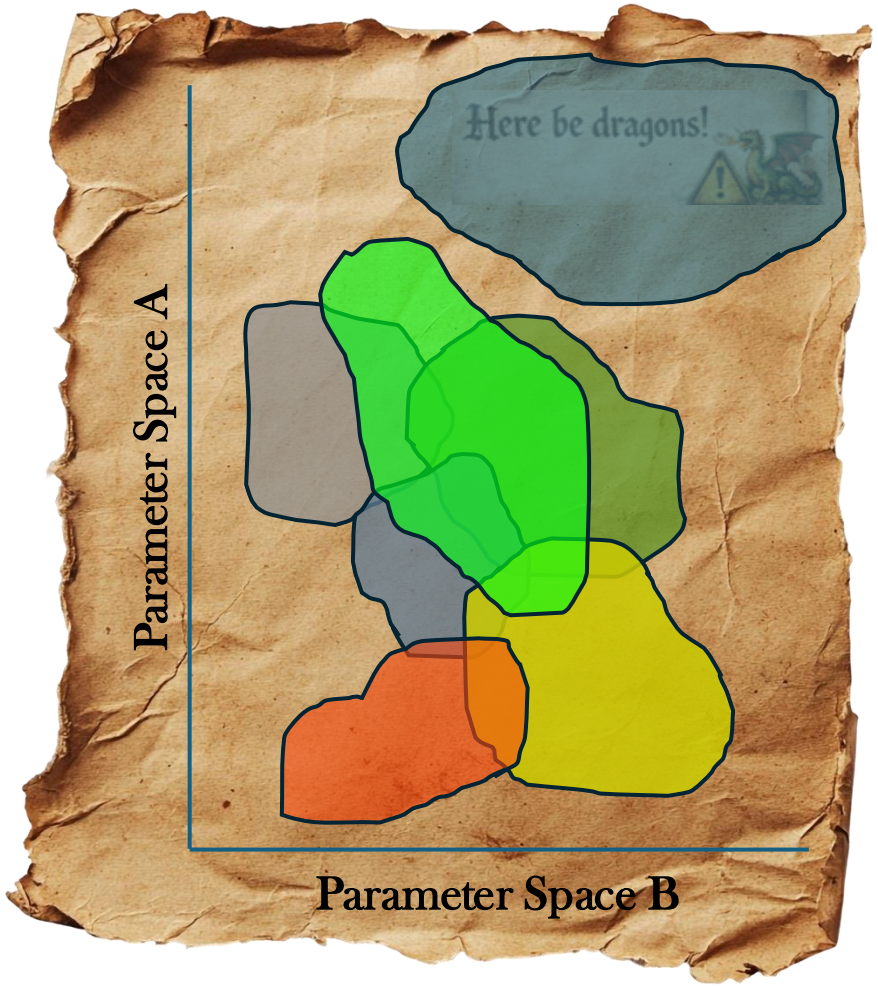
If CASATTA-style then likely great coverage of parameter space in time/FoV – but restricted coverage in frequency bands and baseline lengths.

We mustn’t forget the SKA itself



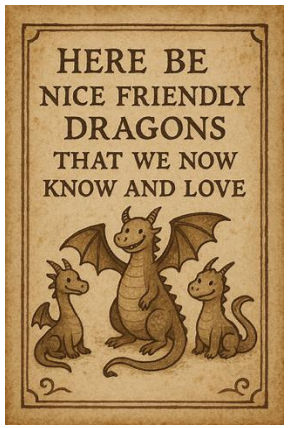
- SKA-mid and SKA-low will cover different regions of parameter space that will overlap somewhat (but not entirely) with our existing facilities
- CASATTA-style ideas would open completely new parameter space from that covered by the SKA

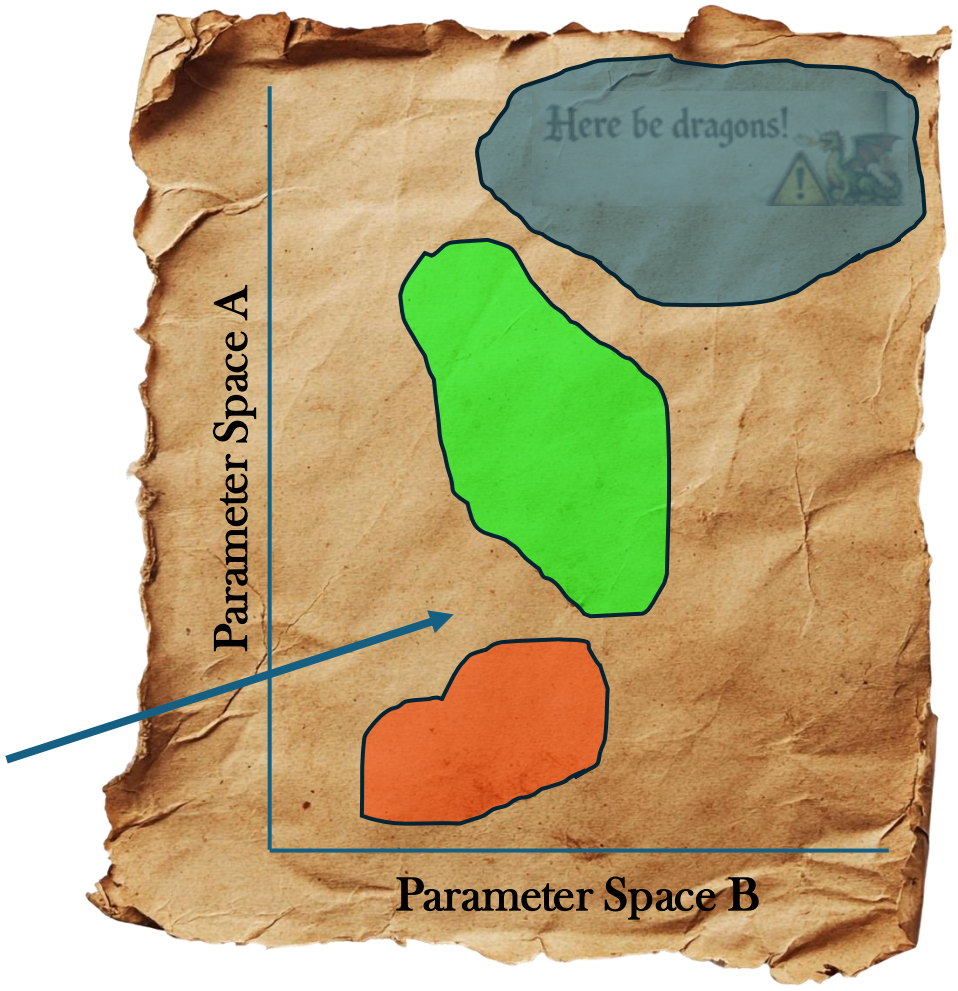
We mustn’t forget the SKA itself



- The “find a new area of parameter space” blob still looks good, but …

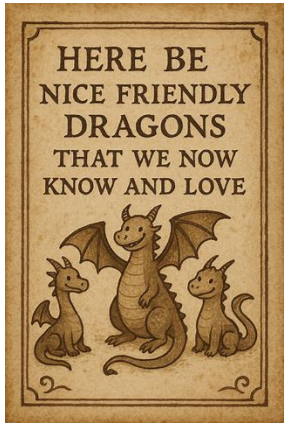
Now we turn off some existing facilities …

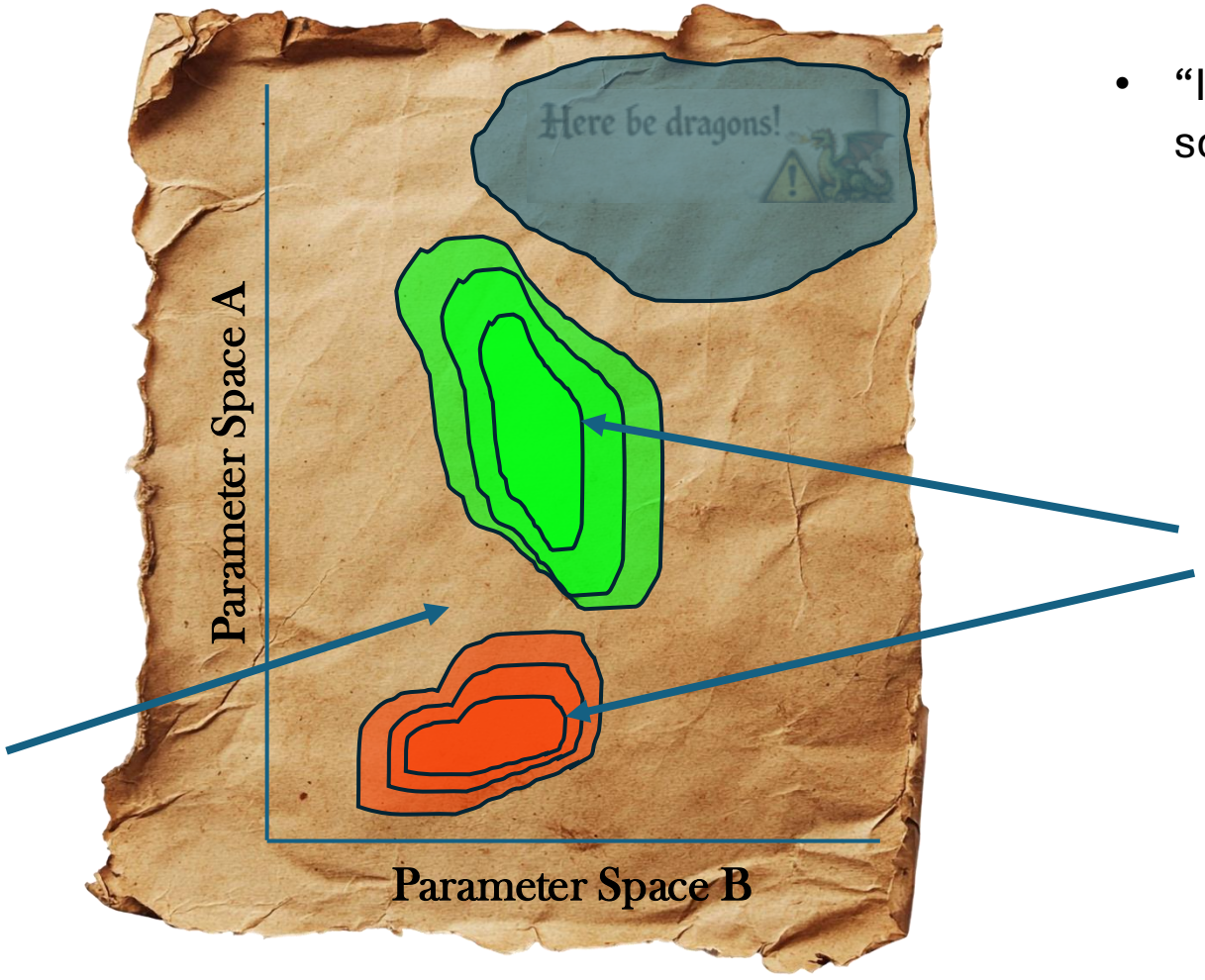




- To fund this new cool bit of science and to operate it into the future we likely (not definitely) would need to "turn off" (some) existing facilities.
- The "Here be Dragons" region is covered, but the "we want to keep studying the dragons that we've already found" parameter space is now looking **very empty**.
- Is this really what we want?

Is this really what we want?





- "Is this really want we want?" (from a science perspective)
  - Depends on how much parameter space the SKA-mid/low really will cover.
  - Note "SKA in 2030" and "SKA with full capabilities" are not the same.
- 2030 capability will be more restricted

Dragon images created using AI. They are not real.

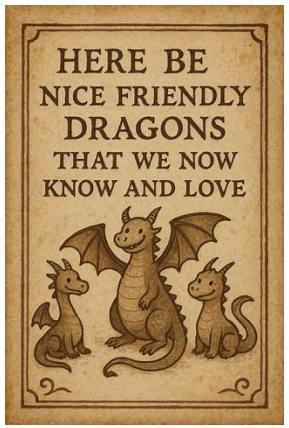
What current ATNF capability will be missing from SKA capability in 2030?

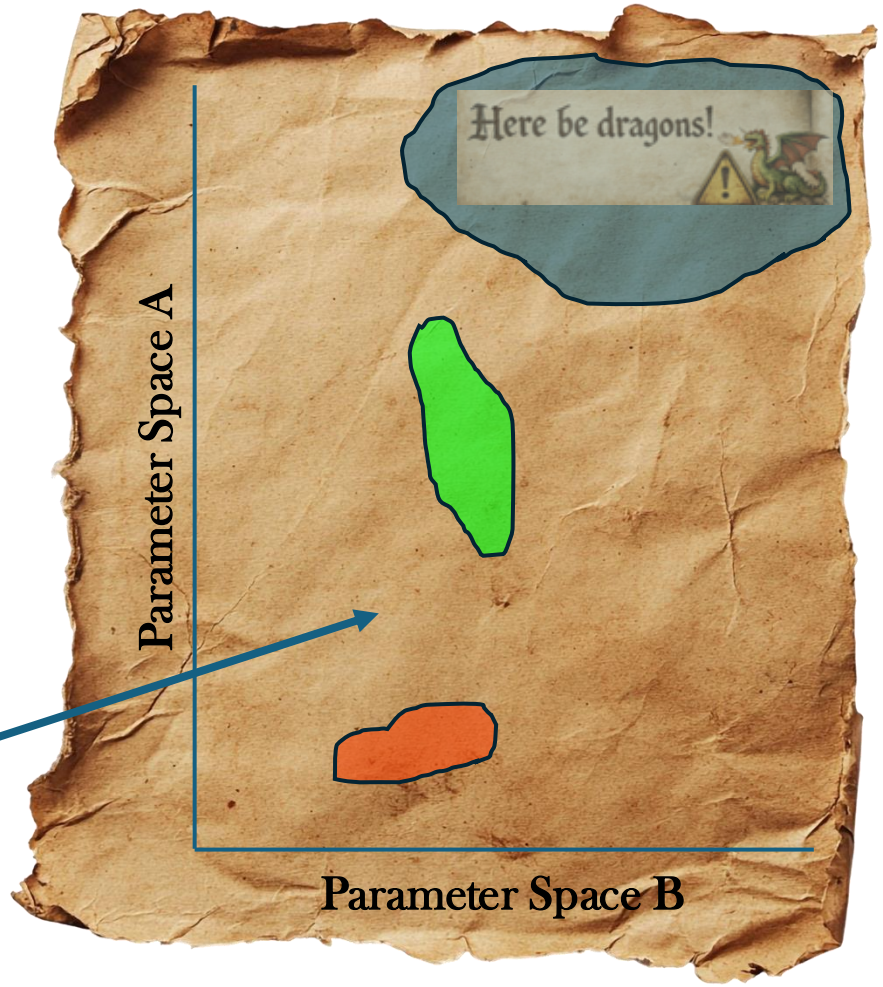
Capability	SKA (around 2030)	ATNF now (or soon)	Primarily which ATNF facility provides capability missing by SKA (2030)
Frequency coverage	Low: 50-350 MHz Mid: likely: Band 1 (350 to 1050 MHz), 2 (950 to 1760 MHz) and 5 (4.6 to 15.4 GHz).	Murriyang: 704 MHz to ~27GHz (with UWM/H) ATCA: 1GHz to ~105 GHz (with gaps)	ATCA and Murriyang
User access	Restrictions likely to "large projects" and "SKA-countries"	Open skies, rapid response modes	All
Baseline lengths	Not VLBI	VLBI (Across Australia and beyond) (and LAMBDA)	LBA (based on Murriyang and ATCA). Mid-frequency VLBI capability in West would be very valuable.
Polarisation purity (off-axis)	Challenges for off-axis polarization purity	"Should be the best in the World"	ASKAP (3rd axis)
Geographic location	Mid: Southern hemisphere, Africa Low: Southern hemisphere, WA	Australia wide	All in Southern and Eastern Hemispheres for Mid. East Coast baselines for Low
Zero baseline capability	None	Murriyang as a single dish	Murriyang
Flexibility for change (new receivers/backends)	Low to moderate (will be very difficult for rapid upgrades and changes)	All telescopes flexible in backends. ATCA and Murriyang more flexible in hardware upgrades.	All, but ease often proportional to number of antennas (i.e., Murriyang is most flexible to change)

What is the proposal?

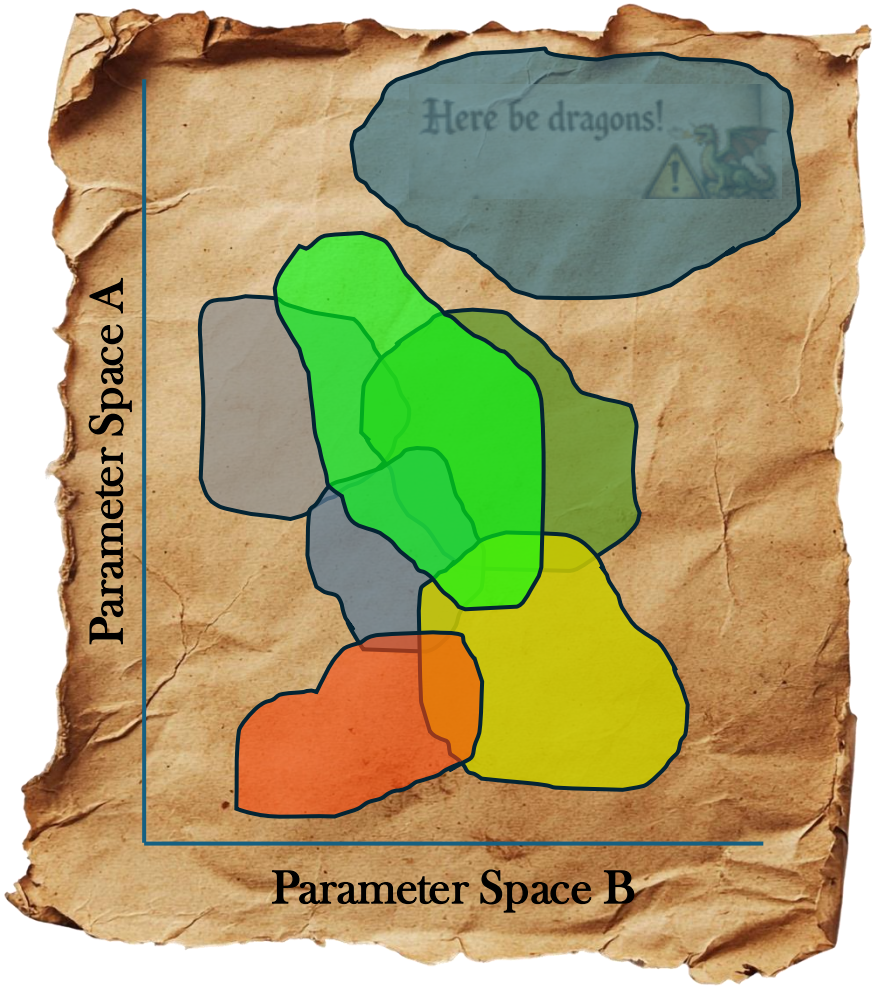
Not: just SKA **and** something completely novel

(when everything delayed will end up with nothing)

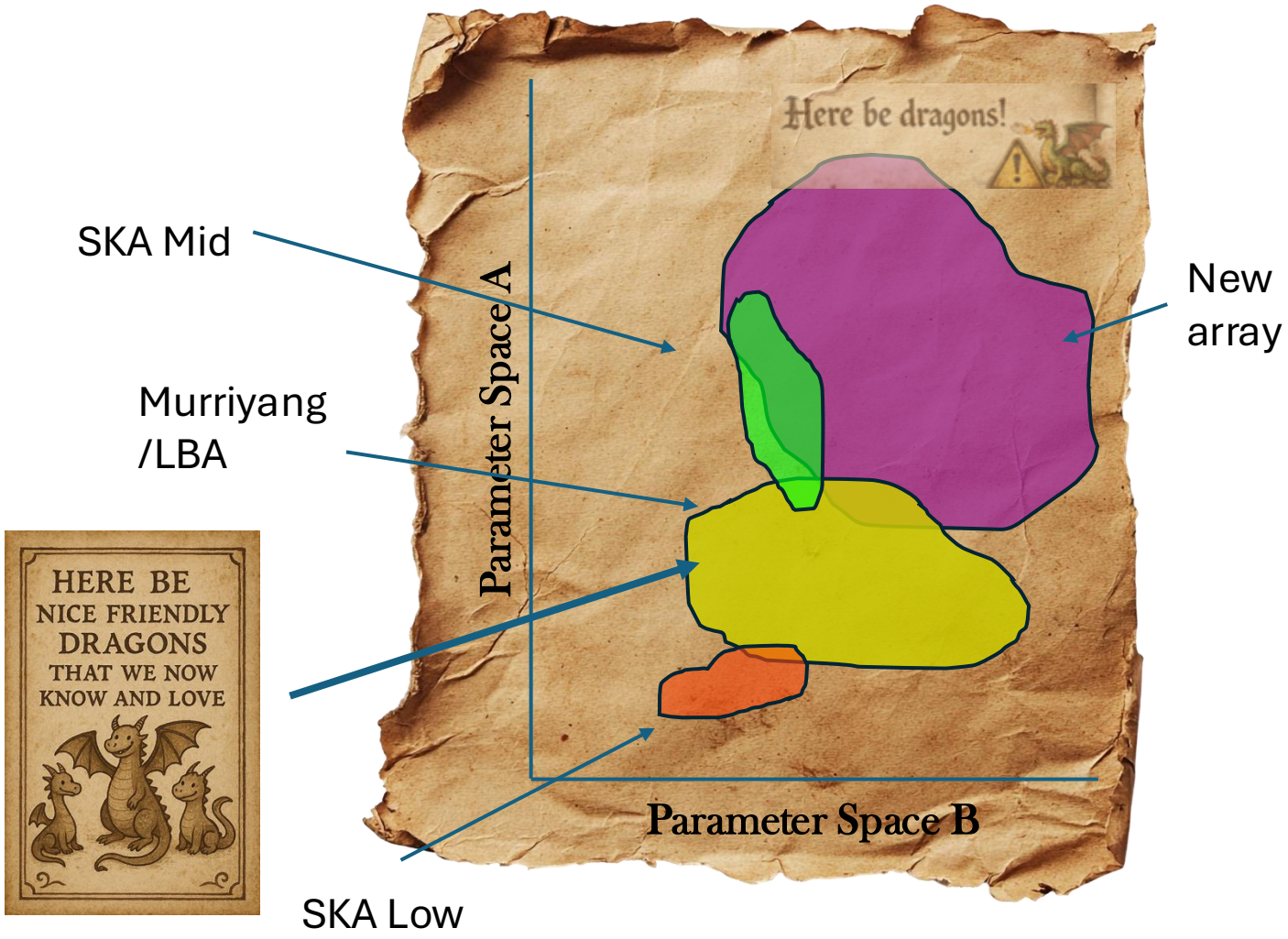




Also not: SKA (potentially overselling SKA's capability in 2030) **and** something completely novel **and** everything we're currently doing



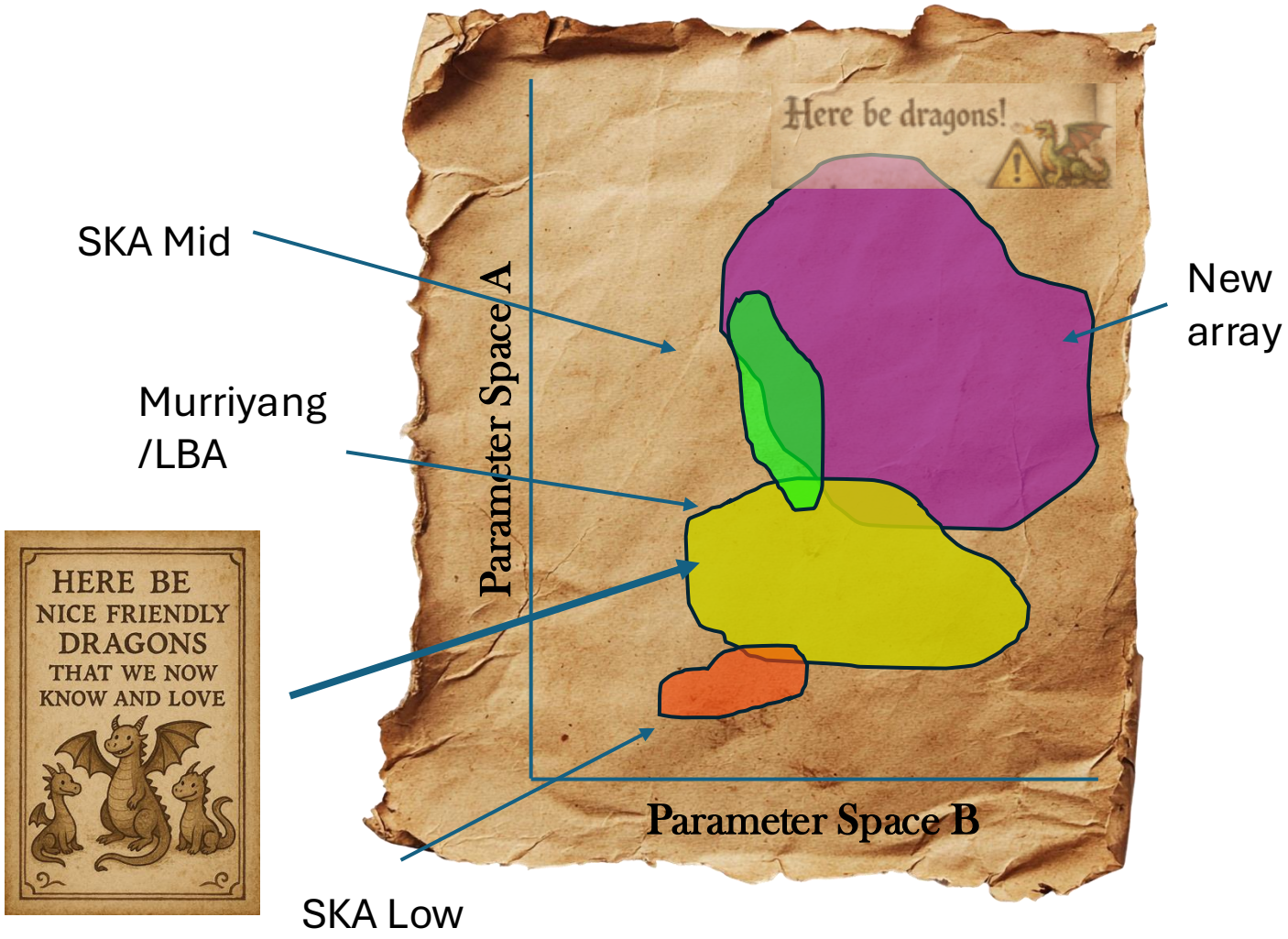
What is the proposal?



- Can we ensure we **can move into part** of the "Here be dragons" parameter space, but **also not lose** the "Let's study the dragons we know (and those that the SKA will find)" parameter space?

- Main parameter space that we might lose:
  - Long baselines (i.e., LBA capability)
  - Frequency agility and coverage

What is the proposal?



Would like to ask the **engineers** "how to solve this problem?"

- My thought is "build an ASKAP/ATCA-combo array in WA, RFI-quiet, have (>6 and <36) dishes that can support wide-band receivers, PAFs etc." => **SKA-mid-style dishes with high-quality wide FoV/wide bandwidth ATNF receivers** (perhaps with 3rd axis rotation)!

- This wouldn't preclude niche experiments like GINAN, something monitoring the Galactic centre ..