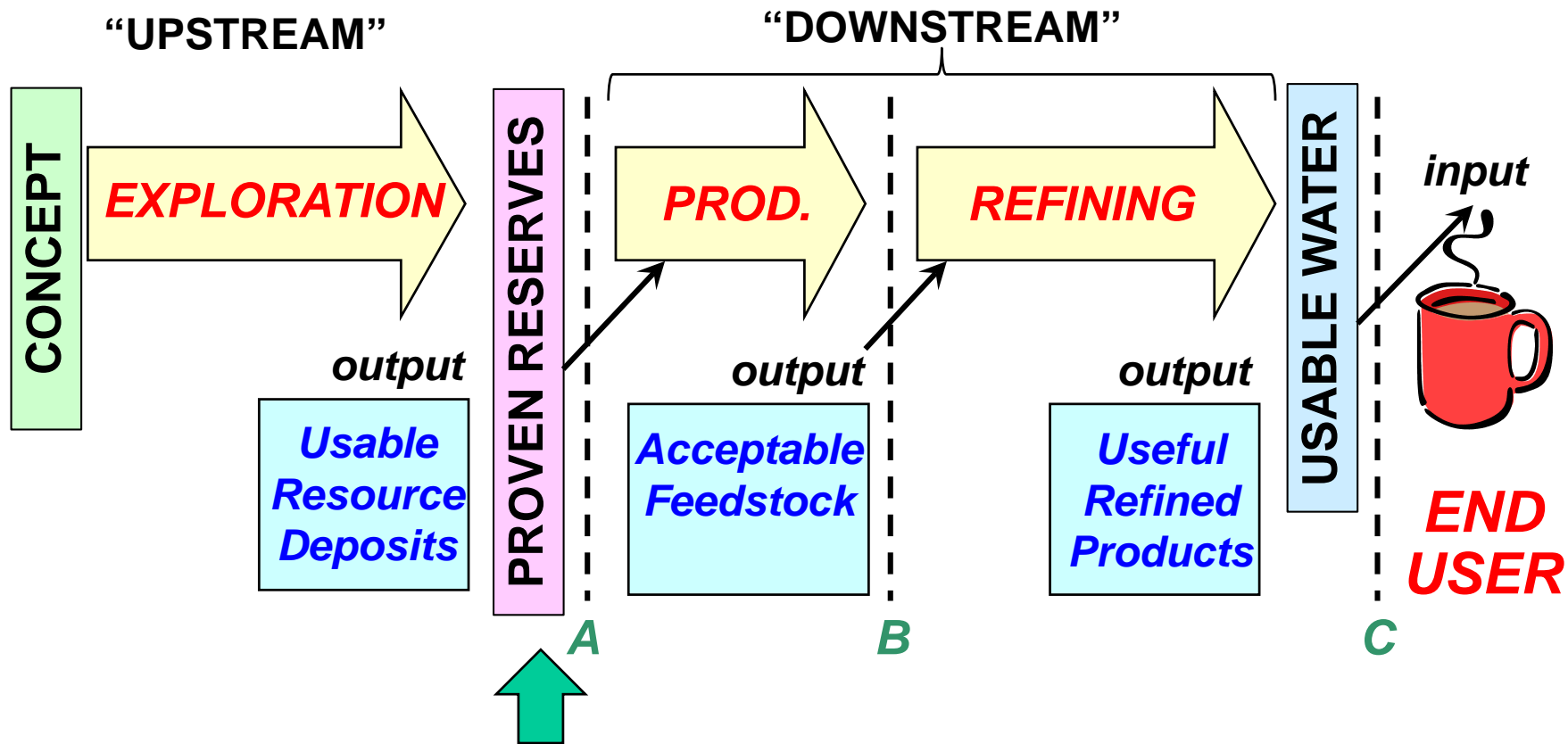




The Exploration-Production Flow



“Reserves” are the essential interface between “exploration” and “production”



Confidence: The Concept of Reserves

| Reserve Classification | Earth Application | Mars ISRU Application | Confidence |
|--------------------------------|--|----------------------------------|------------|
| Proven | Use as collateral for a bank loan | Astronaut lives can depend on it | 99% |
| <i>MAKE COMMITMENTS</i> | | | |
| Probable | <i>SPECIFIC DEFINITIONS EXIST</i> | <i>UNDEFINED</i> | 90% |
| Possible | | <i>UNDEFINED</i> | 50% |
| Potential | <i>THE EXPLORATION ARENA</i> | | <50% |



Some Lessons Learned on Earth

(and these will apply in spades on Mars)

Earth Experience Lesson #1

Cannot define a reserve without specifying how it could be produced.

- Critical link between science and engineering





Some Lessons Learned on Earth

(and these will apply in spades on Mars)

Earth Experience Lesson #2

Perfect knowledge is not possible (until after the fact)

- How much uncertainty can be accepted?





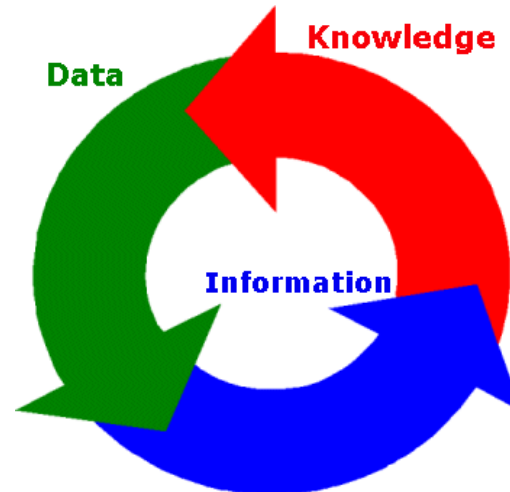
Some Lessons Learned on Earth

(and these will apply in spades on Mars)

Earth Experience Lesson #3

All knowledge is not equally valuable

- Exploration is cost-constrained: You cannot afford to buy all of the information you want
- The decisions on which information to acquire can determine success/failure.
- Information acquisition decisions happen very early





Some Lessons Learned on Earth

(and these will apply in spades on Mars)

Earth Experience Lesson #4

If you assume reserves are there without sufficient exploration, update your resume first.

- Wishful thinking is not a substitute for scientific exploration.

