Tip #1 Explore the Future Systematically...

**FRAMING**
- scoping the project and current assessment
- Domain Description
- Domain Map

**SCANNING**
- searching for signals of change and specific future inputs
- Research Scanning Library

**FUTURING**
- identifying baseline and alternative futures
- Baseline & Alternative Futures

**VISIONING**
- exploring the implications of future scenarios
- Implications

**DESIGNING**
- crafting options and an integrated strategic approach
- Options Integrated Approach

**ADAPTING**
- communications, ongoing monitoring and implementation
- Actions Monitoring Library
First Map, Then Influence
Framing
Tip #2 Think in Three Horizons

Tip #3 Start Explorations with a [Domain]Map
Domain Map: NASA Langley “Future of Work”

- Digital Transformation
- Workforce
- Work Models
- Facilities
- Labs & Policy
- STEEP
Tool: Coggle for Domain Maps
Scanning
Tip 4. Scan for Signals of Change

Source: Houston Foresight - Andy Hines and Maria Romero
.... And collect them
Crowdsourcing a Meeting of Minds: Designing the Future of Work - The Governance Lab @ NYU - 1 views
thegovlab.org/designing-the-future-of-work-2

We're all used to an 8-hour work day. But is it effective? | World Economic Forum - www.weforum.org/...our-day-isnt-working-heres-why

'We are in a Pre-9/11 Cyber Moment' Says NIAC - FEDmanager - News for feds - www.fedmanager.com/...re-9-11-cyber-moment-says-niac

Quantum computers are about to get real | Science News - www.sciencenews.org/...m-computers-are-about-get-real

Elon Musk: Humans must merge with machines or become irrelevant in AI age - www.cnbc.com/...cial-intelligence-robots.html
Futuring
Tip #5 Identify Key Drivers of Change: The Futures Triangle

The Future Moves at Different Speeds

### Aspiration
- Zero Waste
- Pay as You Throw
- Integrated Approaches
- Quantified & Gamified Trash
- Smart Homes & Cities
- Circular Economy
- Greener Values (Postmoderns & Integrals)

### Plausible Futures
- As-a-Service
- DIY: Individual & Community
- Public Enemies
- Shades of Green
- Municipalities Following EPA
- Greening in Style
- Regulatory Nudges

### Momentum
- Unfavorable Economics of Recycling
- Fling & Forget
- Greenwashing
- Global Trash Market

The Futures Triangle

H1
- Inertia
- Global Trash Market
- Greenwashing

H2
- Plausible Futures
- Greening in Style
- Regulatory Nudges
- Municipalities Following EPA
- Shades of Green
- Public Enemies
- DIY: Individual & Community
- As-a-Service

H3
- Aspiration
- Greener Values (Postmoderns & Integrals)
- Circular Economy
- Smart Homes & Cities
- Quantified & Gamified Trash
- Integrated Approaches
- Pay as You Throw
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H1
- Inertia
- Global Trash Market
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H2
- Plausible Futures
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- Aspiration
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- Circular Economy
- Smart Homes & Cities
- Quantified & Gamified Trash
- Integrated Approaches
- Pay as You Throw
- Zero Waste
Tip #6 Understand the Future with Stories

**H1**
Current way of doing things within the domain

**H2**
Zone of transition

**NEW EQUILIBRIUM**
Changing Rules
The system reaches a balance among competing forces that is significantly different from the current balance.

**H3**
Vision of New system

**BASELINE**
Same Rules
The system moves forward along its current trajectory. This is the “official future” and usually considered most likely.

**COLLAPSE**
No Rules
The system falls apart under the weight of “negative” forces.

**TRANSFORMATION**
New Rules
The system is discarded in favor of a new one with a new set of rules.
Historic Example: Knowledge Work

Archetypes Across Three Horizons: Knowledge Work Example

Baseline
> VIRTUAL TEAMS COLLABORATING
Work is increasingly virtual, but progress is evolutionary rather than revolutionary. Work in 2020 is far more decentralized and different in many respects, but the transition is manageable.

New Equilibrium
> SOCIALLY-CENTRIC WORK
Digitization and social networks create new collaboration opportunities, new roles and relationships, as insiders, freelancers, and even customers routinely work together.

Collapse
> BACK TO BASICS
Innovative approaches to knowledge work are put on the back burner as tough economic times and high-profile security breaches call new modes of work into question.

Transformation
> PERSONALIZED PROFESSIONS
Successful new organizational and business models emerge around knowledge work that frees workers to personalize their contributions. Work is largely driven by personal interest. All workers are knowledge workers.
Future of Work

**Breaking Orbit**
(New Equilibrium)

A gradual, intentional approach to guide a symbiotic relationship between people and their tech partners.

**Good to Go**
(Continuation)

Privatization, automation, and virtualization to drive commercial success.

**Failure to Launch**
(Collapse)

Work for people available, but pay is scarce.
Visioning: Implications Analysis
## Tip #7 Identify Downstream Implications

<table>
<thead>
<tr>
<th>Key change from Scenario</th>
<th>One 1&lt;sup&gt;st&lt;/sup&gt; order impact</th>
<th>2&lt;sup&gt;nd&lt;/sup&gt; Order Impacts (for each 1&lt;sup&gt;st&lt;/sup&gt; order impact)</th>
<th>3&lt;sup&gt;rd&lt;/sup&gt; Order Impacts (for each 2&lt;sup&gt;nd&lt;/sup&gt; order impact)</th>
</tr>
</thead>
</table>
| Robot and automation proliferate | Fully autonomous AI technologies capable of symbiotic partnership with humans | 2A. Line between humans and their embedded tech blurs | 3A1. LaRC freely funds advanced augmentation upgrades for employees to improve their work and to encourage their retention.  
3A2. Non-augmented can’t keep up |
|                          |                                  | 2B. Superior AI simply replaces humans | 3b. Sabotage AI to provide its use |
Designing
Tip #8: Identify Issues ….

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Issues/Opportunities</th>
</tr>
</thead>
</table>
| **Good to Go (Continuation)** | 1. How can we increase security without slowing down work?  
2. What is the view around acceptance and importance of private dollars?  
3. How we deal with concept of role of basic research in Federal Labs?  
4. How we deal with loss of control in “open” context in which we both bid and gather?  
5. View around one lab and multiple locations  
6. How do we get ahead of augmentation and role of employer?  
7. To what extent do we move to “project based” employment (instead of lifetime)?  
8. Should we build “mega-facilities” or move to just-in-time/modular facilities?  
9. How do we deal with individual concerns about their personal physical space? (hoteling) |
| **Failure to Launch Collapse** | 10. Managing by FTE  
11. Proactively decide what missions belong where in cooperation with other agencies  
12. How do we get ahead of the need to move facilities?  
13. How and when to design for integration?... with digital transformation/augmentation  
14. How early and how much to invest in digital transformation?  
15. How do we adapt decision-making in a more open idea gathering contact? (“right” of AI)  
16. How to maintain “smart buyer” capability in relevance to AI? |
| **Breaking Orbit NE**        | 17. Explainable AI  
18. How much do we trust digital and augmented technologies (balance between human and digital)  
19. What do we need to train and build/re-train skills? |
| **New Frontier Transform-ation** | 20. How to manage self-tasking teams and individuals  
21. Develop standards and checks for autonomous AI (transparency)  
22. Organize around guiding principles rather than standards (in a dynamic context) |
... and Develop Options

# Getting Ahead of Augmentation

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>What is the issue?</strong></td>
<td><strong>Issue:</strong> 12. How do we get ahead of augmentation and role of employer? <strong>Response:</strong> Getting Ahead of Augmentation</td>
</tr>
</tbody>
</table>
| **Why is it important?**          | People will start augmenting, both as individuals and competitive nations  
                                 | What policies do we have for a workforce that is “mixed”?  
                                 | What about competitive threat and unintended consequences                                                                  |
| **What should we do (actions)?**  | Maintain a diverse mix of augmented and non-augmented (eg. Phd, Masters, etc...)  
                                 | Develop different performance standards  
                                 | Different mix of work roles  
                                 | New criteria to be an astronaut                                                                                             |
| **How to make it happen (resources)?** | Build upon the HRP program to explore and expand use of augmentation  
                                 | Expand scope of biomedical engineers on campus and benchmark                                                                 |
## Tip #9 Build the Pathway

### Getting Ahead of Augmentation

<table>
<thead>
<tr>
<th>Phase 1</th>
<th>Phase 2</th>
<th>Phase 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Identify and monitor external examples of augmentation</td>
<td>• Conduct internal augmentation pilots</td>
<td>• Institute a policy for NASA sponsored human augmentations, including a “human over-ride” capability to deal with potential for runaway AI</td>
</tr>
<tr>
<td></td>
<td>• Create process for security validation of personal electronic devices such as smartwatches, fitness trackers, body cameras, and the like for use at work</td>
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<tr>
<td></td>
<td>• Work with AI Assistant vendors like Amazon or Google on secure in-house chatbot assistant devices and “behind the firewall” LaRC-specific support services for those devices</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Develop customized in-house AI Assistant features which connect to LaRC team knowledgebases, data visualization software, test instrumentation, and other tools which would benefit from hands-free use</td>
<td></td>
</tr>
</tbody>
</table>
Adapting
Tip #10 Track Movement Over Time

Vertical forests

Coming Age of Wood
(Wood skyscrapers)

Architectural Digest

Forest Public and Private Health
(Forest Bathing)

Forest Public and Private Health
(Forest Bathing)

Climate Migrants

Genetics in the Forest

Climate-induced Social Tipping Points

Vertical Forests

TIME
The Tips

1: Explore the Future Systematically
2: Think in 3 Horizons
3: Start Explorations with a [Domain] Map
4. Scan for Signal of Change
5: Identify Key Drivers of Change
6: Understand the Future with Stories
7: Identify Downstream Implications
8: Prioritize and Share Options via Elevator Speeches
9: Track movement over time

If you do your foresight homework, you will not be surprised!