

First, Cause No Harm: Issues in Building Safe, Reliable and Trustworthy Elder Care Systems

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Motivators

2

Thursday
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**Woman,
89, says
relocation
violates
her rights**

She sues her nephew and Hennepin County in an effort to remain in her home in Minneapolis rather than be moved to a nursing home in Wisconsin.

By Warren Wells
Star Tribune Staff Writer

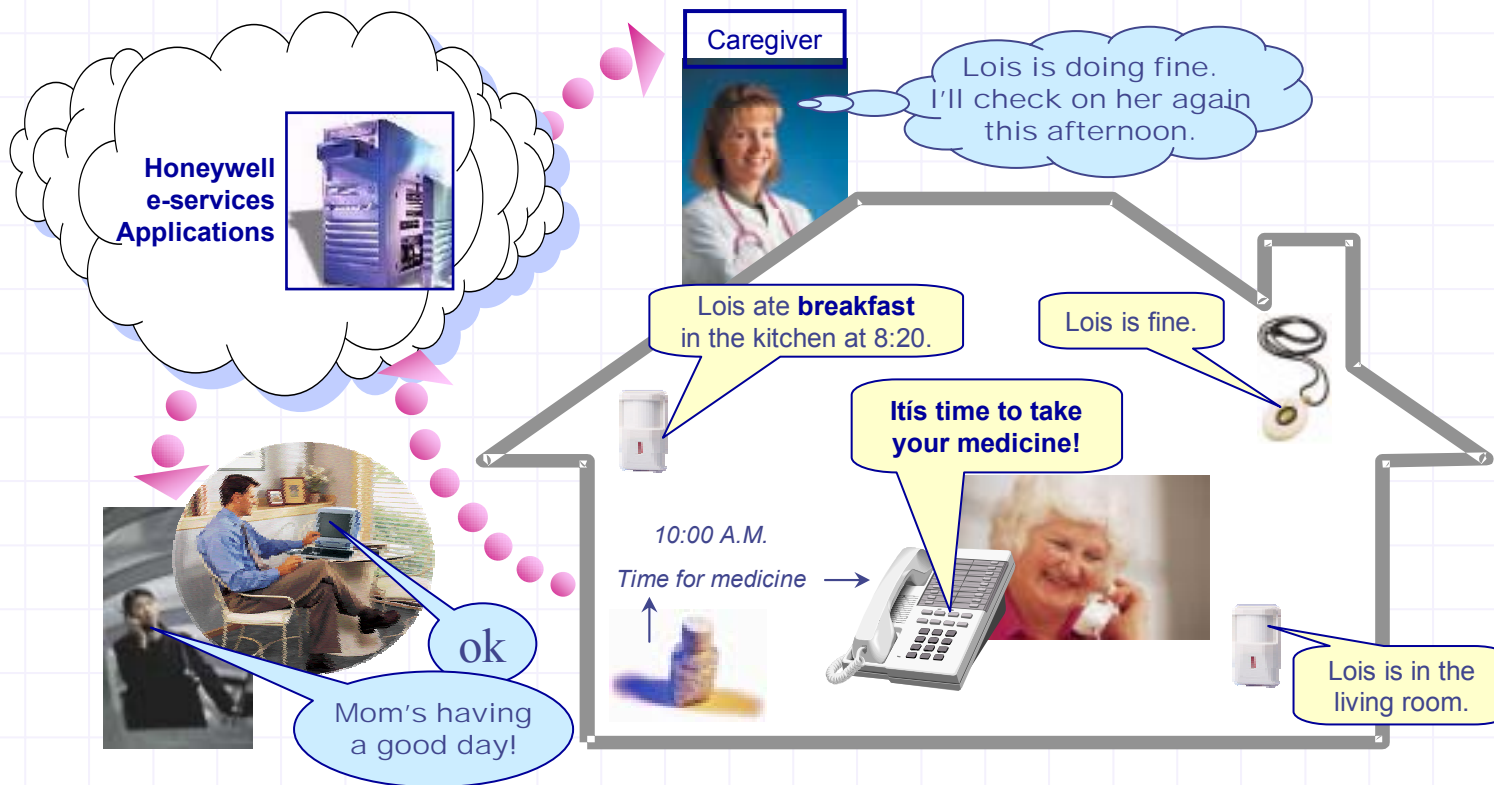
- ◆ Proportion of population >65 growing worldwide
 - ~8% in 2000 to ~17% in 2030
 - especially in industrialized nations

- ◆ 30% of elders prefer to remain in home until death
 - *Health Care Financing Administration*

- ◆ Decreasing number of caregivers
 - families are more distributed
 - families are smaller

- ◆ Nursing home capacity limited
 - 43% of those over 65 enter a nursing home

Independent LifeStyle Assistant



Programmatics:

- ï ILSA is a \$5.3M NIST Advanced Technology Program (ATP)
 - ñ ATPs are high risk research
 - ñ Honeywell 60%; NIST 40%
- ï November 2000 through April 2003

• Activities:

- Year 1: infrastructure and smart architecture development
- Year 2: Configuration and learning
- Year 3: Usability evaluation and tuning

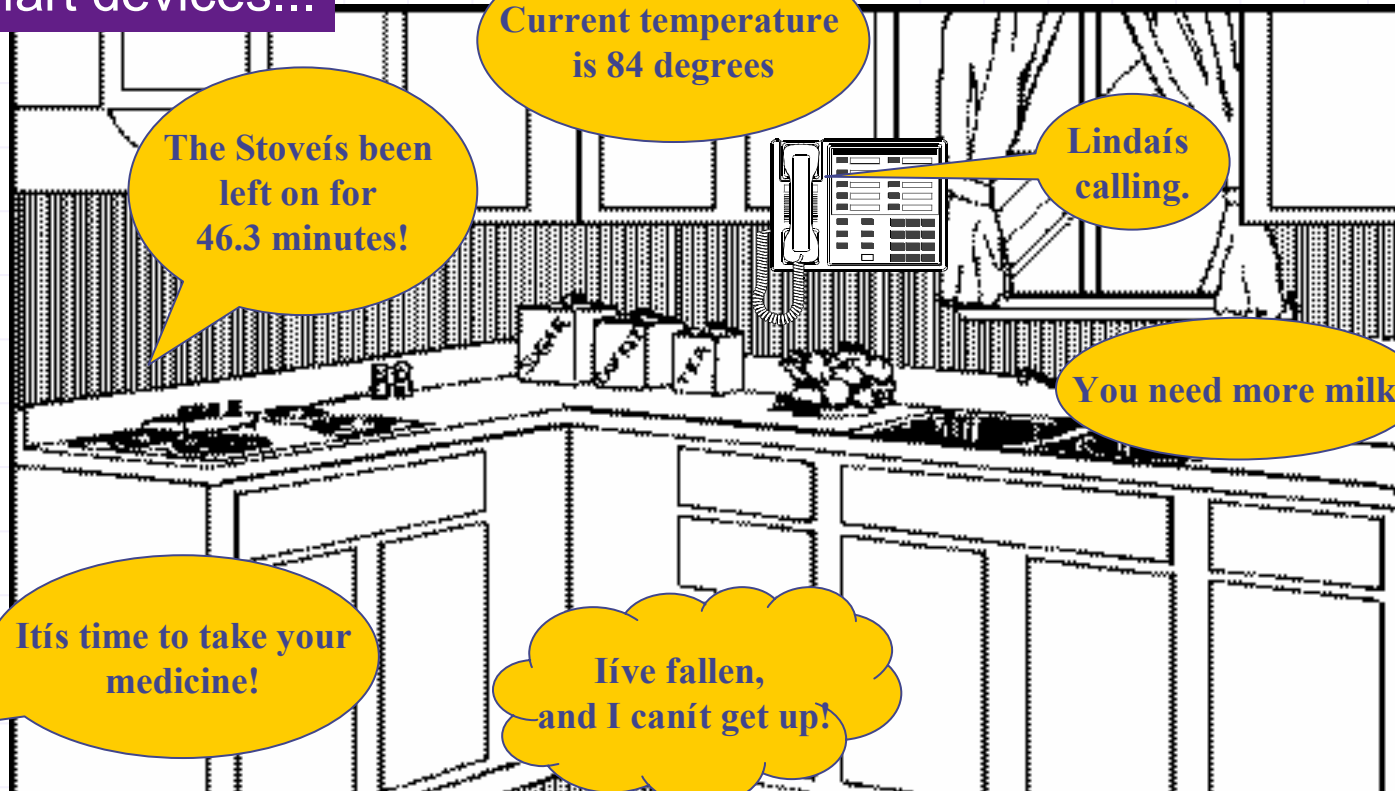
Smart Homes as a Solution

- ◆ Many, many “smart home” and ubiquitous computing projects world wide
- ◆ Smart homes provide automation and information support to
 - Average population
 - Elder/disadvantaged population
- ◆ Smart homes as:
 - Technology development platforms/showcases
 - Technology integrators
 - Communication Layer
 - “Knowledge” Integration and dissemination

ILSA Vision

Smart Devices

Smart devices...



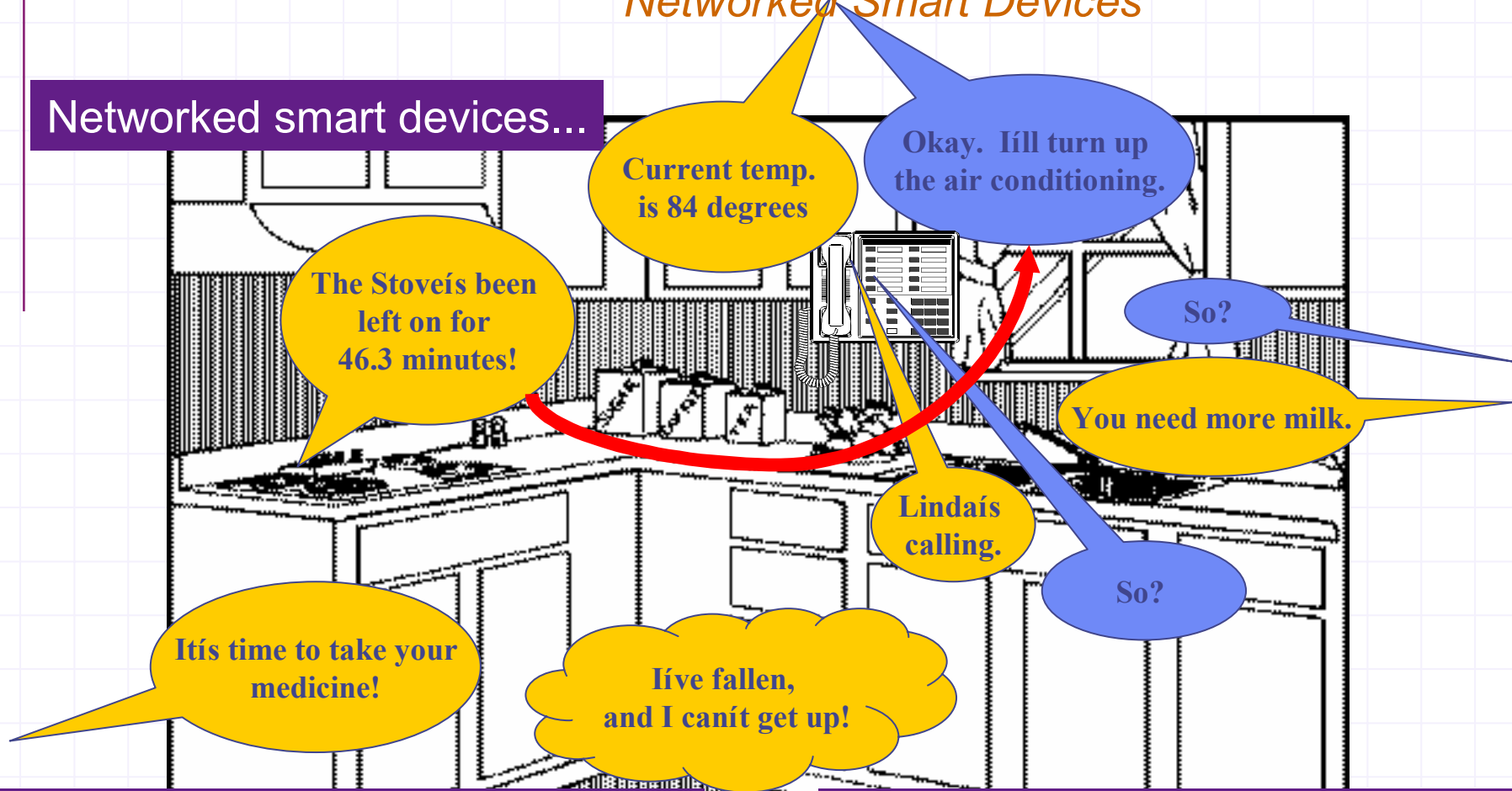
...that don't talk to each other

and can behave inappropriately

ILSA Vision

Networked Smart Devices

Networked smart devices...



...that don't understand each other

and can behave inappropriately

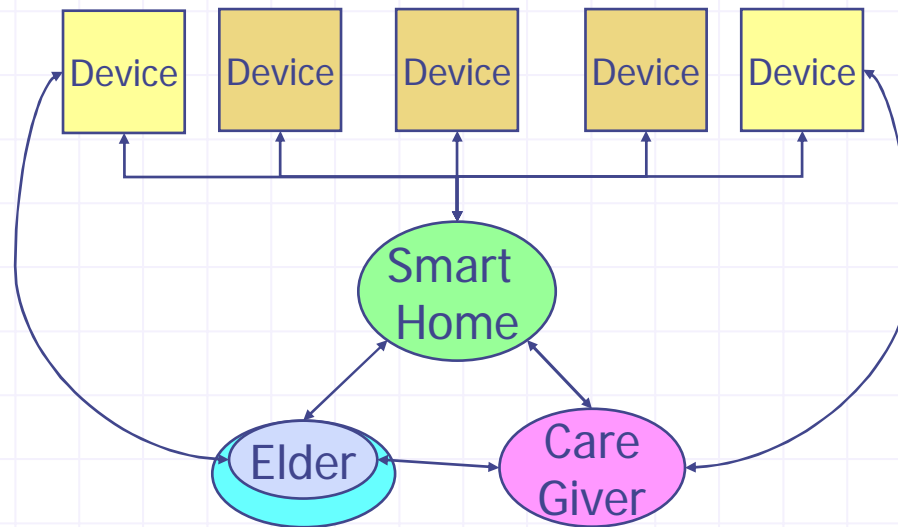
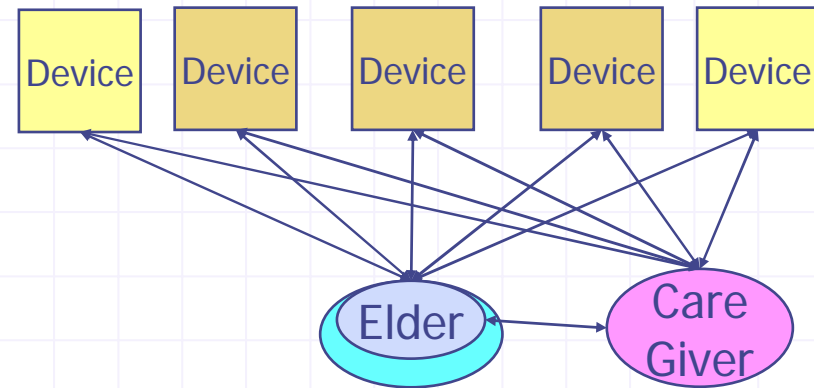
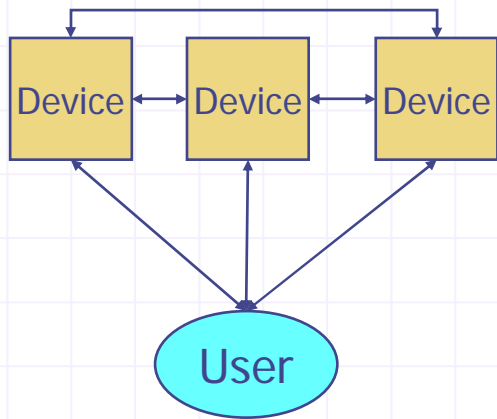
ILSA Vision

Intelligent Integration and Assistance



Ö for appropriate, coordinated behavior in context

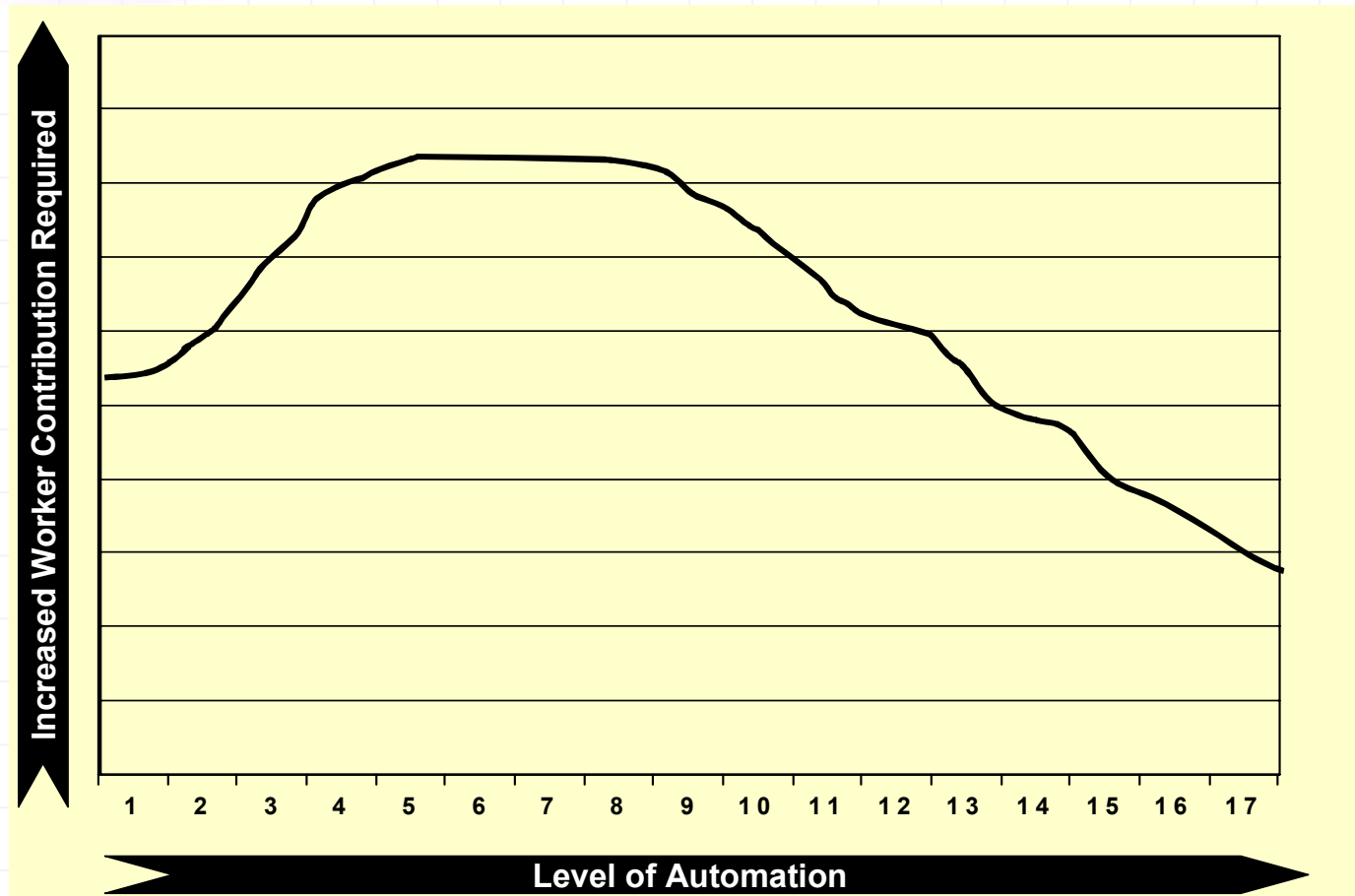
Who Supervises/Integrates Technology?



The Problem

- ◆ Putting Technology in charge of elder care functions will reduce complexity and burden on elder and CG ...
 - ***IFF, it works.***
- ◆ When it doesn't work,
 - The elder will have less capacity to correct, manage, compensate or maybe even notice problems than an "average" user
 - ◆ That's why they're using it in the first place
 - The CG will have less capacity to correct/manage/compensate/notice problems than in current settings
 - ◆ Optimizing CG resources is another motivator
 - And the whole problem context will be more complex than it would have been without the aid

Bright's Evolution of Automation



- ◆ Novel Automation 'evolves' through a predictable lifecycle
- ◆ At intermediate stages, it actually raises skill and workload requirements



So, how should we then design?

◆ Safety-critical system

- Safe
- Accurate
- Reliable
- Comprehensible
- Human-in-the-Loop

◆ Adaptive system

- To user capabilities and needs
 - ◆ Elder
 - ◆ CG context
- To user situation

◆ Affordable and Growable



Some Suggested Design Goals 1

1. *Cause no harm*

- Burden of proof is on technology to not diminish safety
- Quality of life enhancement is secondary

2. *Accurately convey system capabilities and limitations*

- Marketing, and even “user centeredness,” will drive us to present conclusions that the data may not support (“Elder had breakfast” vs. “movement in kitchen”)
- Legal implications?

3. *Design to Enhance, not Reduce, CG involvement*

- Reduce workload, but don't abrogate responsibility
- Critique decisions instead of suggesting them
- Facilitate interactions rather than reducing them
- Legal Implications?



Some Suggested Design Goals 2

4. *Avoid depending on Elder for data input*

- Either at configuration or during operation
- Intrusive and unreliable
- Will fail when most needed

5. *Don't prohibit the Elder from providing input*

- Will improve usability and, probably, accuracy
- Will reduce feeling of watched and supervised by system

6. *Design for Growth*

- Technologies will evolve to meet these criteria– non-disruptive growth of system is desirable
- Especially true for the user interface

7. *Design for Change*

- Elder's and their needs will change over time (both long and short term)
- System reasoning must be adaptive to elder changes



Some Suggested Design Goals 3

8. *Design for Variance*

- ◆ Other safety critical aiding systems select and train users or have dedicated, designed use environments
 - ◆ Neither is true here
- ◆ User variance will be extreme– both between and within individuals
- ◆ Usage environments will also be extreme– a custom-designed and built Smart Home is unrealistic for most
- ◆ Affordable, easy setup and customization are highly desirable, as is dynamic user adaptation

9. *Design to Enhance Quality of Life*

- ◆ Aging is hard enough, technology designed to help shouldn't make it harder.



Tests for New Technologies?

1. Does it enhance safety?
 - Not “is it safe?”
2. Does it enhance Quality of Life?
3. Is it accurate/reliable enough to do 1 and 2?
4. Is it usable/useful enough to do 1 and 2?
5. Is it affordable?
6. Is it growable and adaptable?



Resolved: That for at least the next 5 years, all fielded Caregiving Automation (CA) technologies should be subject to a certification and monitoring process patterned after those used in the aviation industry."

Details

- ◆ Technology certification by the Caregiving Automation Administration (CAA) prior to fielding
- ◆ Certified training programs for caregivers interacting with specific CA ("Check out")
- ◆ Tracking service and database for CA technology incident and accident reporting-- the CA Safety and Reporting System (CASRS).
- ◆ Specific CA technologies subject to commanded or advised recalls, revisions or stop- or change-use orders by the CAA.
- ◆ Social worker assigned to monitor health and well-being of the elder and the impact of the CA.
- ◆ After 5 years, the CAA will be reviewed and may be disbanded. If retained, the CAA may remove specific CA technologies from monitoring and certification.