Readiness Assessment for Video Cell Phones

SE 602

15th March, 2006

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Executive Summary

This report presents analysis regarding the level of readiness of video cell phone technology. Video phones are devices capable of sending audio and video simultaneously from one source to another over normal phone lines. We've seen video enabled cell phones that look stunningly better than past video phones. So the capability of video cell phones is there. This Technology Readiness Level (TRL) analysis is going to be useful for deciding the adoption of video phone technology. The initial readiness assessment shows that videophones are a relatively mature technology, which leads us to believe that they have just not been put in the form factor that is going to make them a smashing success.

Introduction

This report will present analysis regarding the level of readiness of video cell phone technology. Ketan Dadia and Mike DiGiovanni produced this report along with the analysis included in the report.

The rest of the report will go over the history of video phones in their other form factors, give a more in depth description of the purpose of this report, describe how the analysis was performed and ultimately it will present the results of the TRL application and a summary of the document

Background

This has been done as part of an exercise for a technology assessment course under the supervision of Professor Wang. A needs assessment for video cell phones was already completed as a previous exercise in this course.

Video phones are devices capable of sending audio and video simultaneously from one source to another over normal phone lines. Theoretically, this should bring forth a more emotional means of communication; however, past instances of video phones did not have that occur.

Cell phones can combat many of these issues and that is the reason for this needs assessment. Cell phones can be used practically anytime, anywhere; Transmission speeds can be much higher than landlines. We've seen video enabled cell phones that look stunningly better than past video phones. This shows us that the bad quality of previous video phones can easily be overcome. This can easily be seen in Europe, where video is commonly sent to and from cell phones. Users there have grown accustomed to the fees associated with the ease of sending and receiving video.

The next generation of video cell phones has the capability to be more emotional. You can bring friends and family with you to exotic destinations and talk to them as though they were there. This was something that was impossible with past video phones due to their size and need for a landline.

Technology Readiness levels have various uses. Their primary use is in helping management make decisions regarding a technology's lifecycle. This knowledge can be used to help manage funding for a technology as well and where the next phase of the technology should head.

Purpose

The analysis done for this document is to determine whether or not the current technology for video cell phones is ready for the world to adopt and enjoy and the point in its lifecycle that the technology

is currently at. This analysis could be used by anyone planning to manage a project built around video cell phones. It could help to estimate funding or decide what the next step for video cell phones should be.

Limitations

We've provided analysis based on the entire videophone technology. Since general videophones are so tightly entwined with video cell phones, this seems like the best way to provide analysis of the readiness of video cell phones.

The TRLs and TRL calculator also have their own inherent limitations. It's hard to say whether or not these calculations are scientific or just something thrown together. Does the TRL really provide meaningful data to analyze? Other sources have said that TRLs are not sufficient for defining the true readiness of a technology (5). TRLs are a relatively new thing and are still unproven. Conducting the analysis is also a time sink. A lot of paperwork and reporting is involved in providing meaningful analysis. Additionally, System engineering items not handled in early stages of TRLs (5). TRL tells us nothing about potential, only where we are now.

History

1964 was the start of the complete failure of video phones. AT&T unveiled Picturephone, a system to transmit both audio and video over a telephone lines. (2) The hardware and service were both expensive and the systems never faced widespread installation. In 1970, Picture Phone is offered to the public at $160 a month. Shortly after that, Ericsson shows off the first trans-atlantic video phone call.

The 1980s brought forth a series of video conferencing systems. In 1982 Compression Labs began selling a $250,000 system with $1000 an hour lines (4) PictureTel followed with a cheaper system at $80,000 and $100 an hour lines. Towards the end of the 80's Motorola released a still picture phone. At $1,500 it proved to be too expensive to be successful and it was abandoned in 1989.

In 1991 Picture Tel released a cheaper video conferencing system at $20,000 and $30 an hour. Later that year IBM and PictureTel collaborate to demonstrate videophone on PCs. This led to many videophone solutions being developed that use a pc. That continued throughout the 90s but never really caught on with the public. In 1992 AT&T released a videophone for the home market at $1,500.

In the 2000s video capabilities on cell phones start to become widespread. Nearly every cell phone has at least picture capabilities. Many begin to be able to send video with sound, although not in real time.

This is for several reasons. One reason was the cost. Another reason for the failure of picture phones was privacy. People do not always want to be seen by the person they are talking to. With fixed location picture phones, you were stuck looking at a wall if someone decided they didn't want to be on camera.

Picture quality was yet another issue that contributed to the demise of past implementations. Many early implementations were black and white with low frame rates. This made for unemotional video.

There was a period in the 90's where relatively low cost video phones hit the market. Those failed as well. The failure of those was that they weren't designed for business use, and the average home user does not just want a static scene when people call somebody. This is why video cell phones can be successful. With every video cell phone call your caller will see you in a new location with new background. This brings some excitement to video phones.

Current status brings us to cellular video phones. As of today, video phones still have not hit the mainstream. People don't know who has video cell phones and many people have not used them. Video cell phones are the next step and possibly the phase with the most promise of success.

They are portable, hardware independent, easy to use, they can be cheap. Cell phones are widespread with video features already creeping into mainstream cell phones. Cell phones are hot products; throwing video phone capabilities into this would be a future strategy. Video cell phones could be the turning point for today's videophones.

Methodology

TRL analysis has been in use by NASA for many years. The first incarnation of TRLs involved seven levels and encompassed start until launch. The current version of TRLs involves nine levels and was expanded to track readiness post implementation, when a technology is finally out in the wild.

The below table is a table of the definitions of the various levels of TRLs.

Level	**Definition**
1	Basic principles observed and reported
2	Technology concept and/or application formulated
3	Analytical and experimental critical function and/or characteristic proof of concept
4	Component and/or breadboard validation in laboratory environment
5	Component and/or breadboard validation in relevant environment
6	System/subsystem model or prototype demonstration in a relevant environment (Ground or Space)
7	System prototype demonstration in an operational (space) environment
8	Actual system completed and (flight) qualified through test and demonstration (Ground and Space)
9	Actual system (flight) proven through successful mission operations

Table 1 (6)

Instrumentation

The TRL calculator is an excel file. It contains a series of macros and set of question that once answered provides an analysis of the readiness of a technology at that point in time. The questions are separate into hardware and software categories to provide that someone using it will not have to face questions that may not be applicable. Since this tool uses the same questions every time it is used, this can be applied to multiple projects to get an idea of their readiness with respect to each other.

The calculator provides a view into the past but cannot help in predicting what the future holds for a given technology. The results can be used to aid deciding where to head in the future though. Mature technologies are more likely to pay off on investments, whereas a new technology is much riskier. This could also be used as a sort of gauge toward how far you are in reaching the next TRL.

Results

Overall the video cell phone technology that we analyzed achieved green levels of readiness at level 8 for all of technology, manufacturing, and programmatic readiness. We set the green level at 100%. We achieved yellow levels of readiness up to level 8 for programmatic readiness, level 8 for technology readiness, and level 9 for manufacturing readiness. The yellow point was set at 67%. Results can be seen in the below figure.

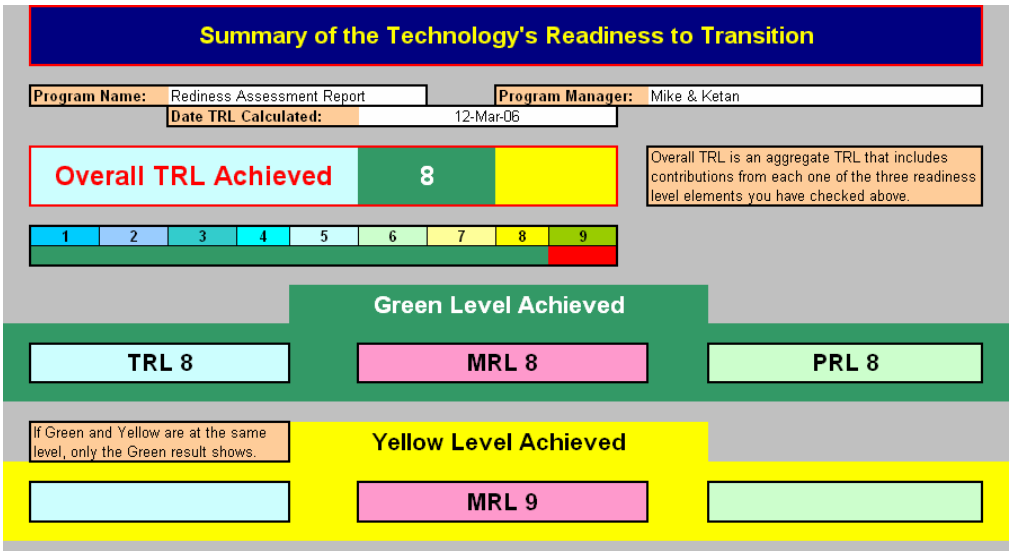


Fig. 1 TRL Summary

We achieved green levels here with one hundred percent coverage of the criteria. These are the basic levels of the technology before any implementation work is done. The first 8 levels were achieved due to the maturity of the technology. As was explained in the history, video phones have been around for quite a while.

For TRL 9 we achieved a red level. There were 14 criteria to be met. We met 10 of those. This is the final level and it shows us that we are not at a level where our technology is going around and being used. Detailed information about the TRL is defined in the appendix.

Concluding Remarks

The TRL Calculator simplifies the process of applying TRLS to research and development programs. This has helped us to gauge the readiness of video cell phones. It looks like the technology is definitely ready. Most of the phases have been completed. Based on our current results it looks like the next

phase of videophones will be a much more mature technology. Based on early phase history it looks like the next phase could be approaching marketability very soon. Positive outcomes are in the very near future.

References

1. W. Nolte, B Kennedy and R. Dziegiel, Technology Readiness Calculator, 6th Annual IDIA Systems Engineering Conference, October 20-23, 2003

2.http://muse.jhu.edu/demo/technology_and_culture/v044/44.1lipartito.html,

3. http://dailywireless.org/modules.php?name=News&file=article&sid=4946

4. http://myhome.hanafos.com/~soonjp/vchx.html

5. https://www.safaq.hq.af.mil/organizations/ace/documents/tra.ppt

6. http://www.dtic.mil/ndia/2003systems/nolte.ppt

7. http://en.wikipedia.org/wiki/Technology_Readiness_Levels

Appendix

Fig 2 shows the selection for demonstration environment, this provides a base set of readiness. The selection chosen has been selected because of the past history of video phones.

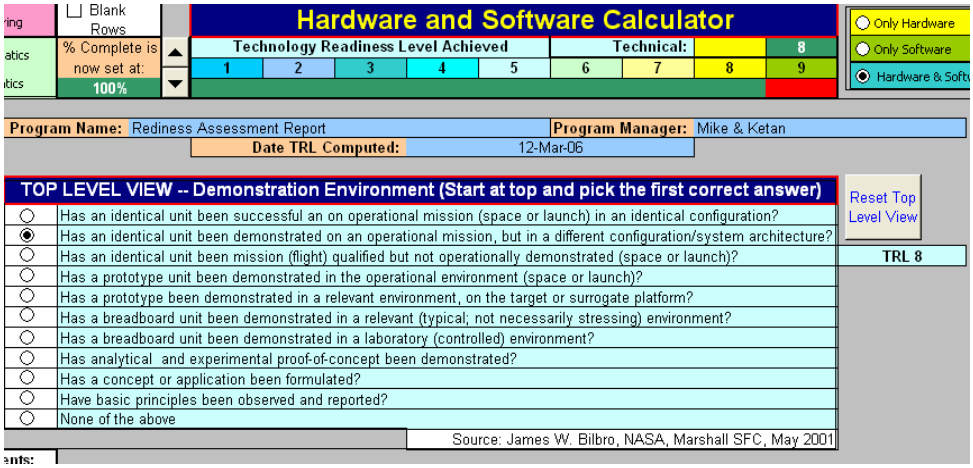
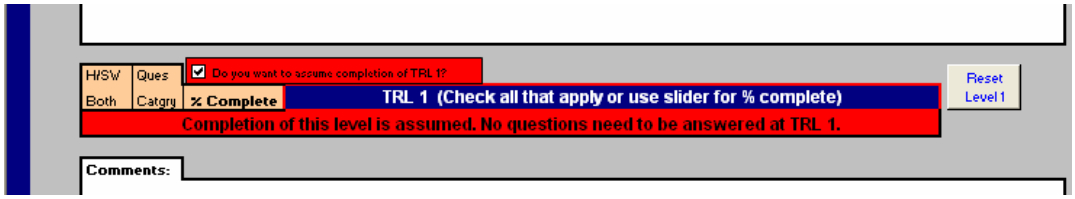


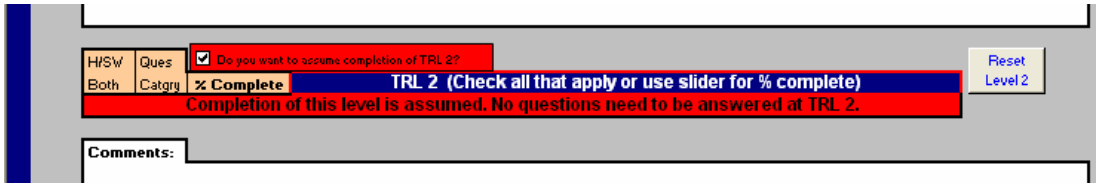
Fig. 2 Top Level View

TRL's 1through 8 were completely filled in as the technology is already here. We've provided screenshots of all criteria in the sections for reference.

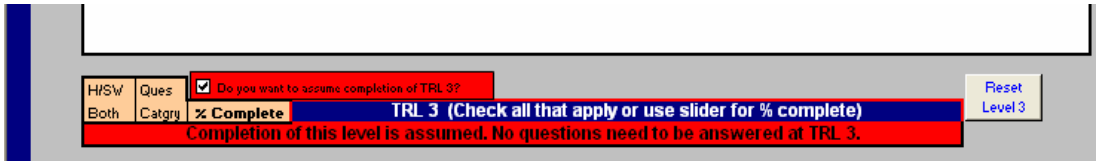
TRL 1: Completed



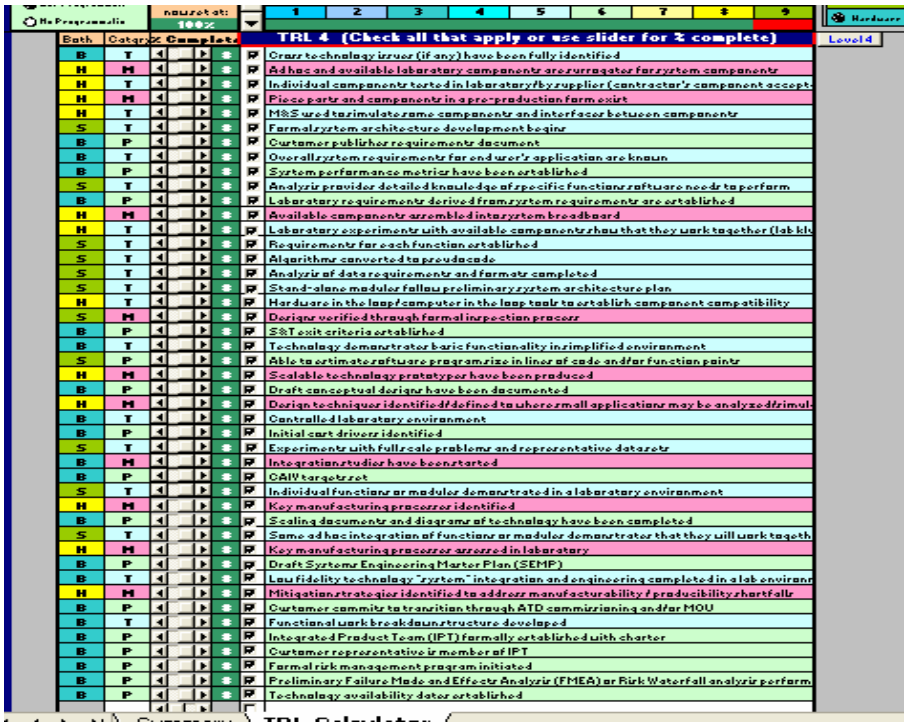
TRL 2: Completed



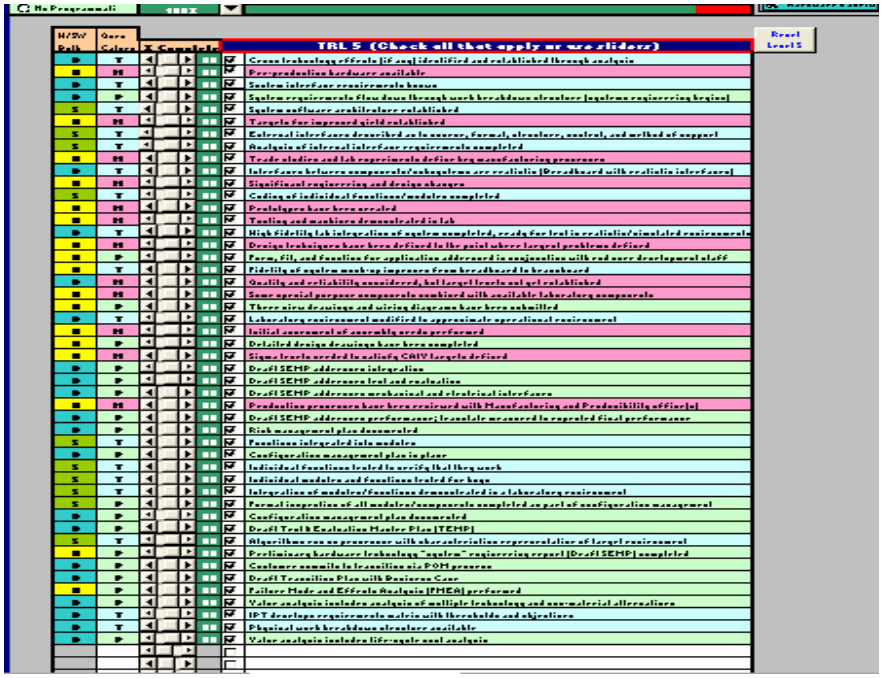
TRL 3: Completed



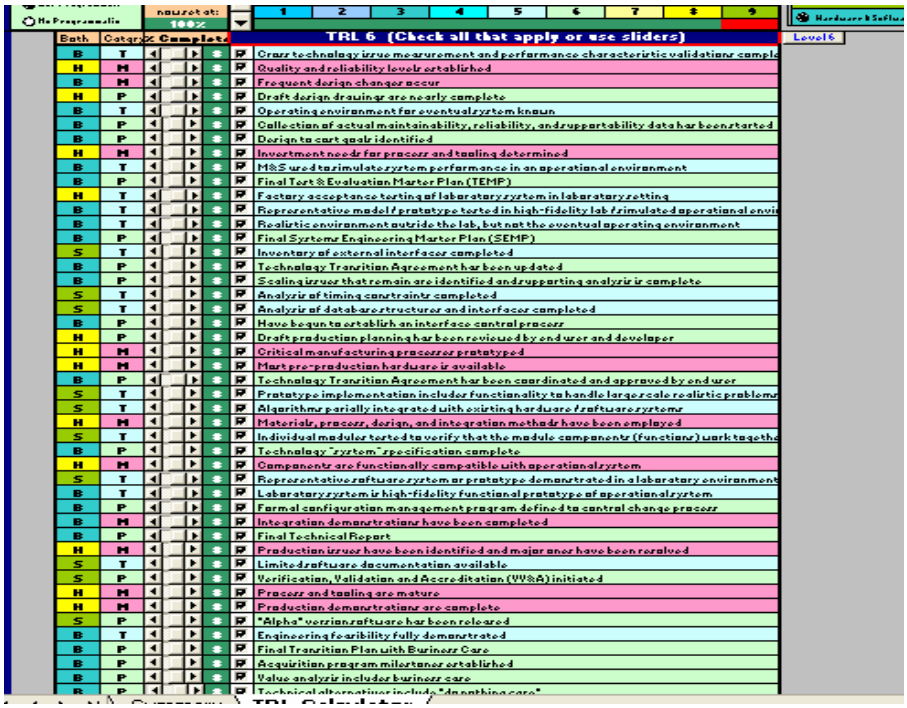
TRL 4: Completed



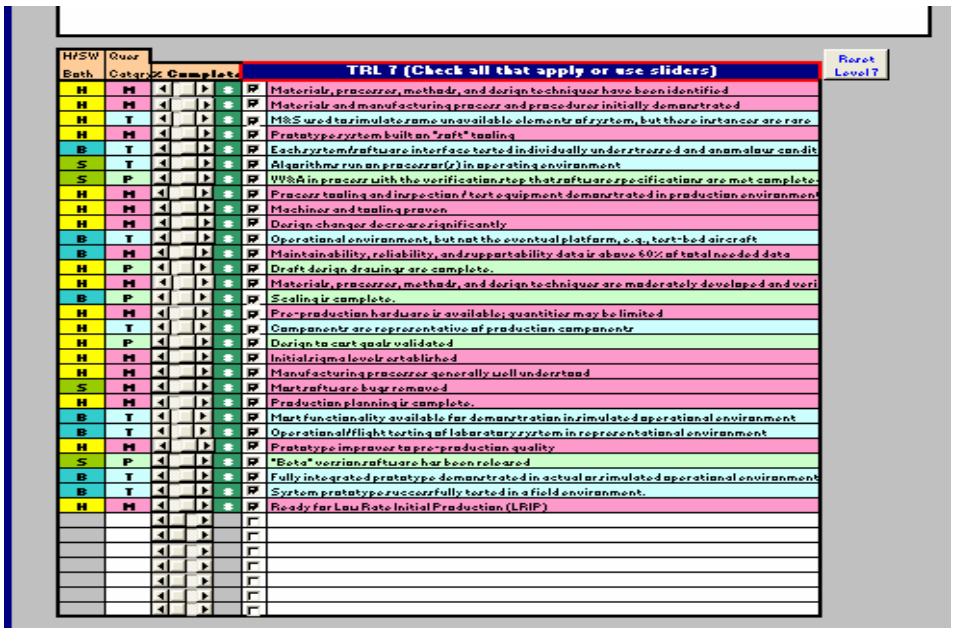
TRL 5: Completed



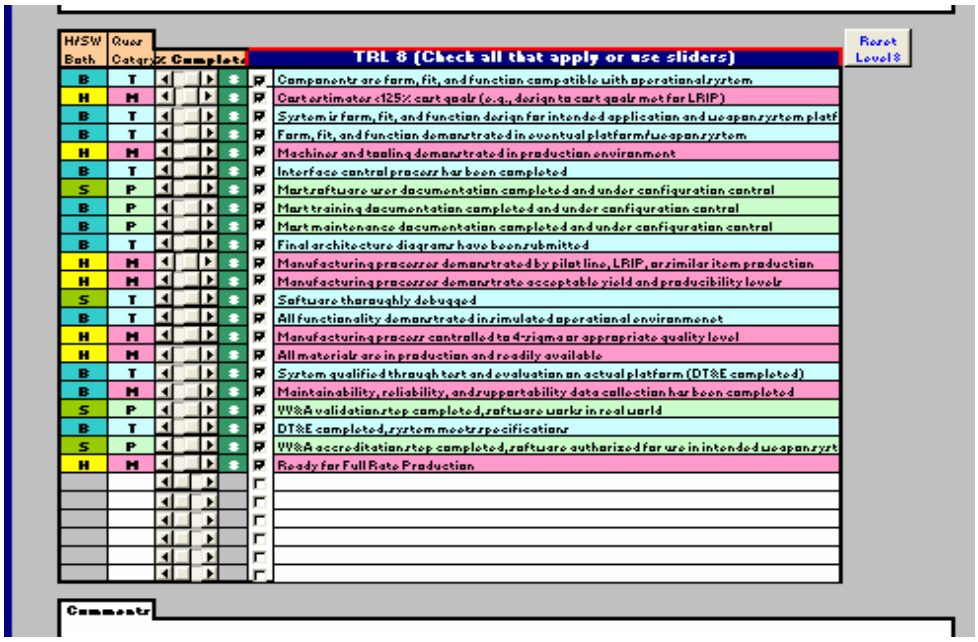
TRL 6: Completed



TRL 7: Completed



TRL 8: Completed



TRL 9: is for a system that has been proven through successful use. 90% of documentation and training has been implemented. 85% of initial production and evolutionary milestones has been reached.