

# SeeMe

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Mr. David Barnhart, Program Manager  
Tactical Technology Office

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# Observation: Commercially available information puts lowest echelon warfighter at an asymmetric disadvantage

## Premise:

Today, individual insurgents operate inside US military squad and individual image information timelines...

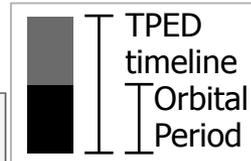
...yet remote, squad level ops are driving need for image information "on-demand".

## Observation:

As satellite cost goes down, constellation size increases, delay times due to satellite overpass decreases...

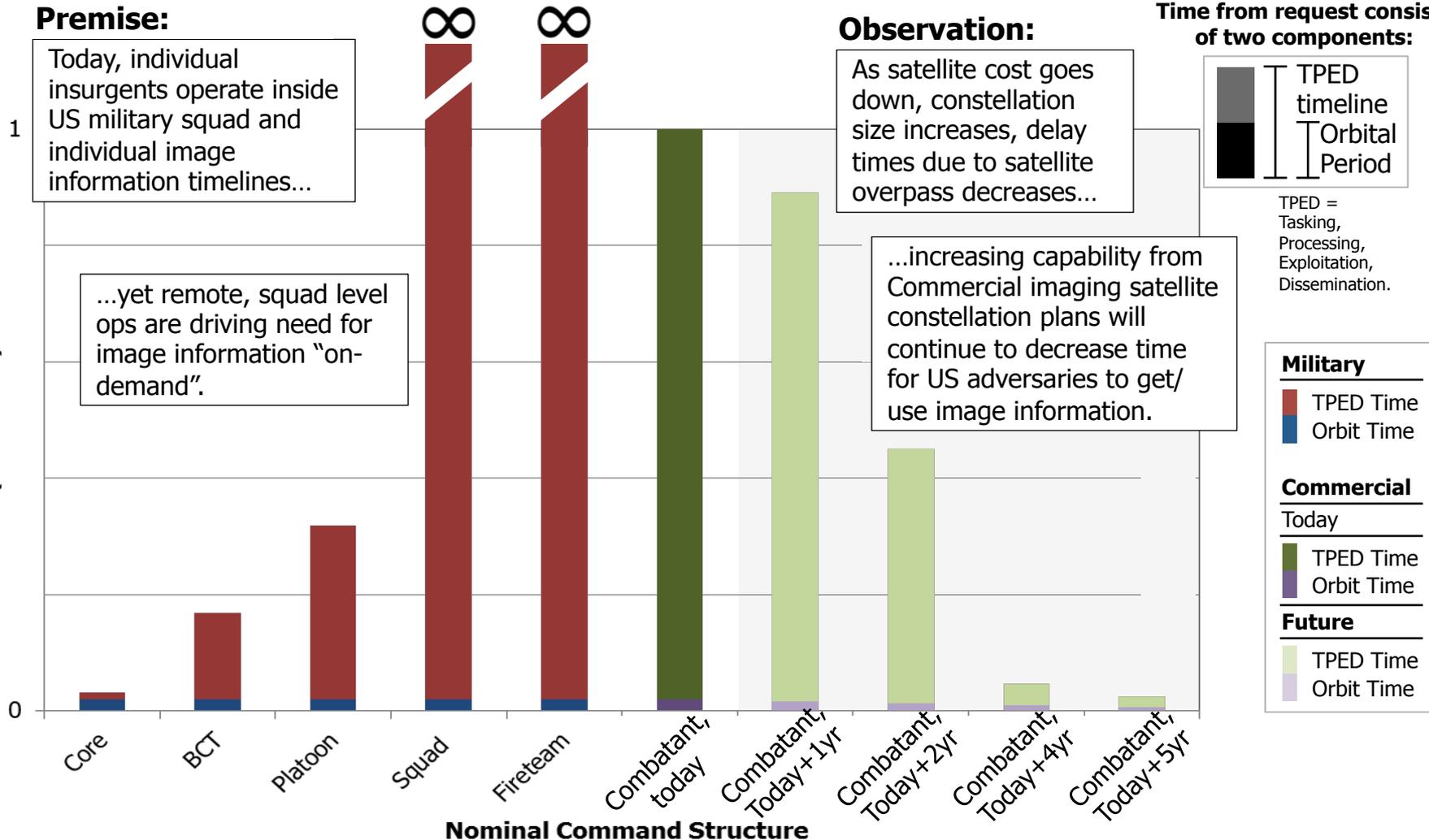
...increasing capability from Commercial imaging satellite constellation plans will continue to decrease time for US adversaries to get/use image information.

Time from request consists of two components:



TPED = Tasking, Processing, Exploitation, Dissemination.

Time to Deliver Image from Request (normalized)



### Military

TPED Time  
Orbit Time

### Commercial

Today

TPED Time  
Orbit Time

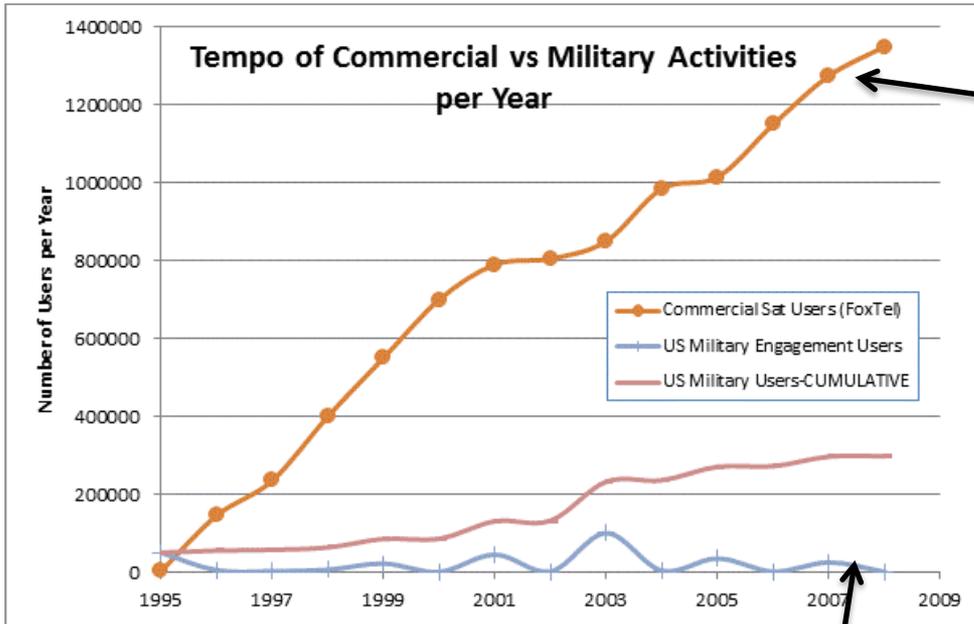
### Future

TPED Time  
Orbit Time

Challenge: Provide timely, tactically useful, reliable and persistent information to the lowest echelon DoD warfighter.



# Observation: Currently military deployment needs are based on intermittent tempos over large time scales

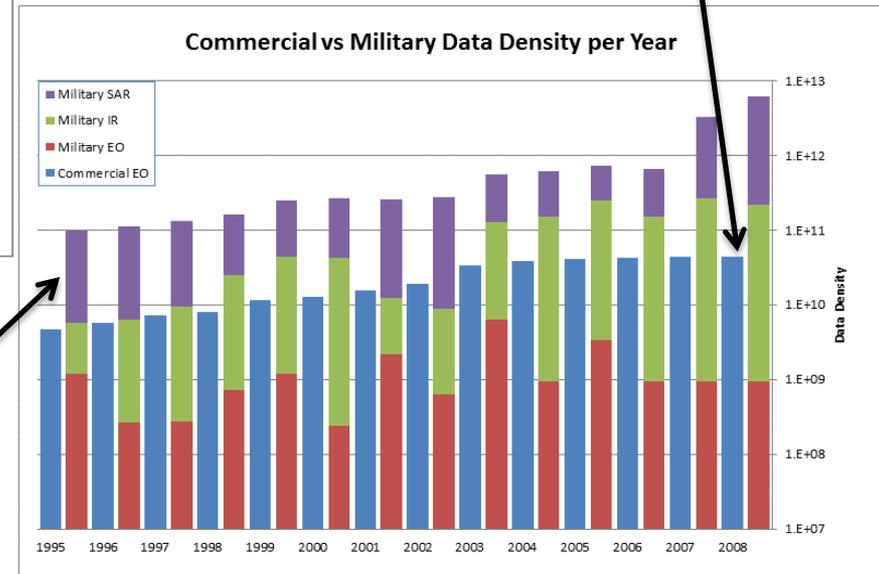


Commercial "market" is constant or increasing related to satellite operations, and have stable "revenue."

### Comparison of typical satellite user base to number of soldiers deployed over time:

- \* ["Foxtel delivers subscriber, profit and TV viewing share growth"](#) (Press release). Foxtel. 20 February 2008.
- \*\* [Wikipedia search on troops deployed over time.](#)

...yet DoD user needs are non-continuous over time, has non-stable "revenue/value over time", and requires higher data density.



Data density described as modality GSD x number of pics/year

Challenge: Provide a "production" capability for satellites that supports non-continuous tempos without driving up cost.



# SeeMe Concept - Movie

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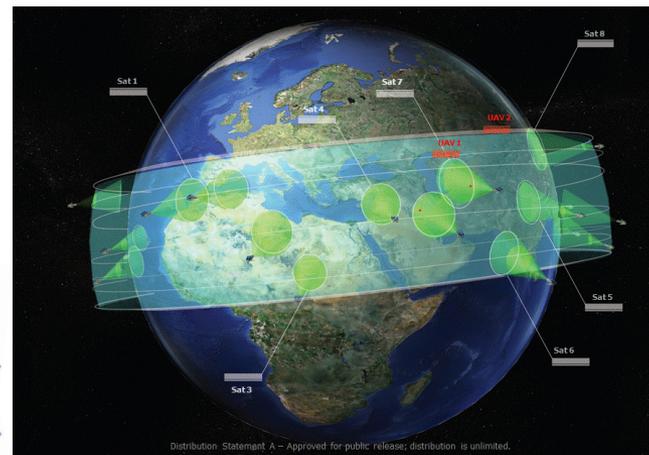




SeeMe goal: To enable mobile individual US warfighters access to on-demand relevant space-based tactical information



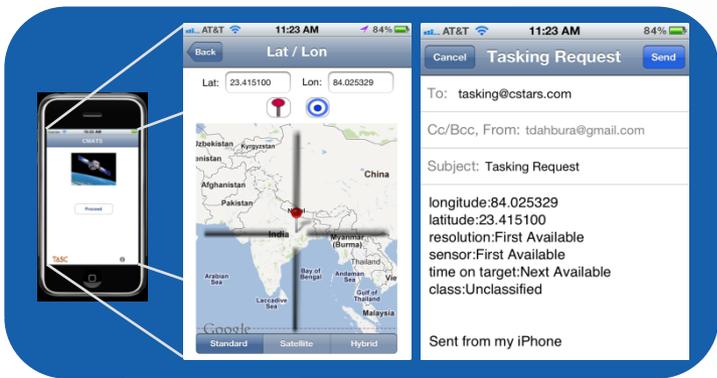
ALASA Launch



Notional 24 small satellites inserted to LEO, +/-10 deg latitude with goal of <90 min revisit

SeeMe constructs:

**COTS-based, production capable, low-cost satellite bus.**  
 +  
**Non-traditional high-performance membranes and apertures.**  
 +  
**Aircraft-like rapid launch systems and logistics.**



Direct request/downlink of NIIRS 5.5 level imagery to lowest echelon members of US military in the field



# SeeMe Notional Concept of Operations

Satellite is released into predefined orbital slot to create/join constellation

ALASA Launch Vehicle launches single "SeeMe" Satellite

Individual satellite hears a "SeeMe" call from User

Satellite positions itself & takes a NIIRS 5.5 image of user +/- 5 km area

Image is transmitted back down to user within minutes of request

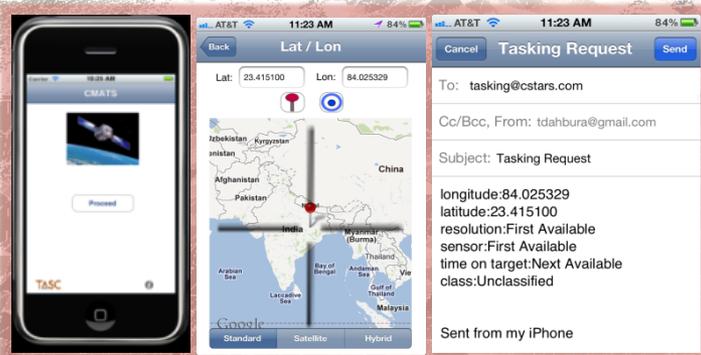
F.O.V of imager

CAOC

Estimated area that satellite can detect a "SeeMe" call

"SeeMe" request, e.g., Latitude, Longitude, Time, ID, etc

Estimated Field or Regard for satellite imager





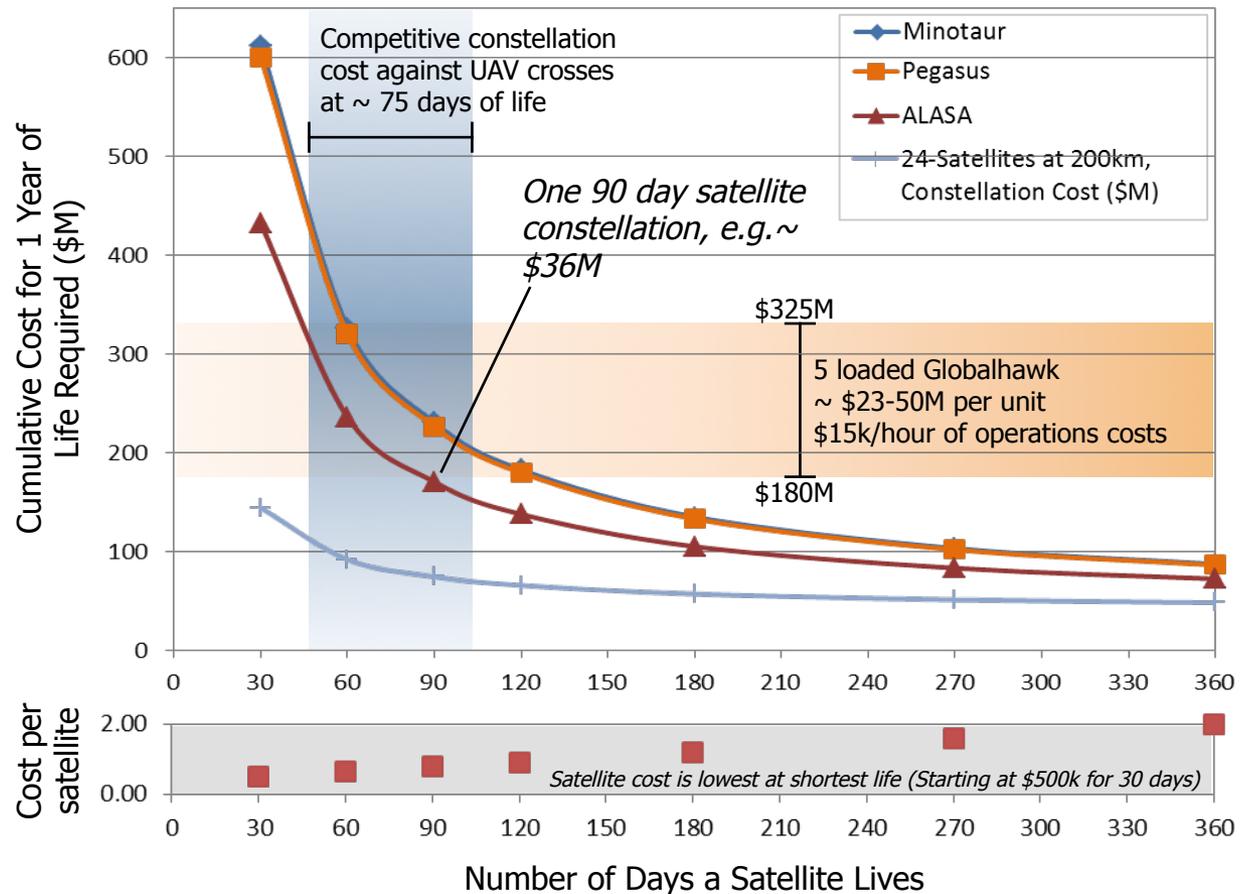
Technical challenge: Create a price point that does not change relative to non-continuous military needs, yet competes at airborne-like costs

## Where is the "real" price point?

Cost is sensitive to per unit cost of satellite optics, bus, and labor.

## Where are the "real" tempo drivers?

How long the satellite lives on-orbit depends on internal lifetime and altitude.



**Price point challenge: Provide a satellite constellation at the price point of a fraction of a single airborne asset for DoD intermittent operational tempos.**

Translating to initial SeeMe satellite cost goal: < \$500k/each at production rate.

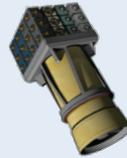


# SeeMe must address a change in the satellite build model from "performance centric" to "cost centric"

## 1<sup>st</sup> - Attack lowering fixed costs with non-aerospace components and industries for bus:

- Enable non-continuous production levels at cost.
- Use COTS reliability standards.
- Build in commercial tempo refresh/obsolescence.
- Use non-aerospace vendor processes for build and validation (i.e. NO PDR/CDR reviews).

COTS based satellites (artist rendition)

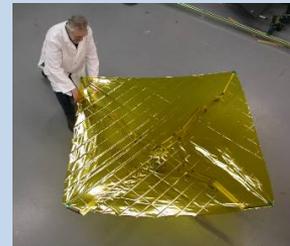


Non-traditional Industries

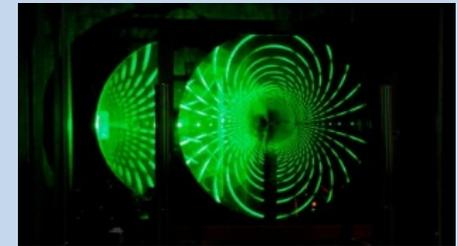
<p><b>CMOS Industry</b></p> <ul style="list-style-type: none"> <li>• Embedded control.</li> <li>• Solid state components.</li> </ul>	<p><b>Cell Phone Production</b></p> <ul style="list-style-type: none"> <li>• Processor.</li> <li>• Memory.</li> </ul>
<p><b>Stainless Fabrication</b></p> <ul style="list-style-type: none"> <li>• Stamping.</li> <li>• Mechanical forming.</li> <li>• Laser machining.</li> </ul>	<p><b>Pneumatics</b></p> <ul style="list-style-type: none"> <li>• Valves.</li> <li>• Manifolds.</li> <li>• Actuators.</li> <li>• Lines/tubes.</li> </ul>

## 2<sup>nd</sup> - Invest in/integrate non-traditional aperture technology:

- Increase aperture (RF or optical) by order of magnitude over existing systems.
- Accept performance at cost.



Flexible CubeSat array for UHF-X Band (DARPA Seedling)



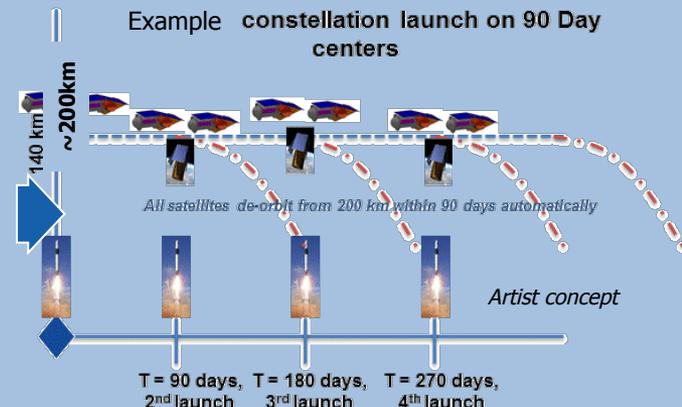
Non-traditional imaging technologies (DARPA's MOIRE)

## 3<sup>rd</sup> - Decrease satellite lifetime requirement and enable increased satellite flight tempo:

- Design satellite constellation "launched on schedule."
- Conform to actual DoD ops tempo, NOT satellite life optimization (90-180 days planning, 90-180 days operation).
- Conform to Internationally accepted commercial transport and storage.



Artist rendition





# SeeMe Notional Technology Focus Areas

## Focus Areas:

### COTS-based production capable S/C bus

Commercial industry component integration

Vendor based reliability & COTS obsolescence

Non-continuous production

## Capabilities:

- Build 24 satellites w/in 90 days from ATP.
- Compatible with ALASA, 45kg and launch to min 200km.
- Proven cost stability with intermittent acquisition.

## Goals:

- \$500k per satellite target at production run.
- Provide 90 minute persistence to request for image.
- 30-120 days life at ALASA orbit.

### Non-traditional membranes & apertures

Imaging apertures & components

RF apertures & components for Space to Ground

Advanced concept low volume stowage and deployment

- EO baseline with NIIRS 5.5 @ 300km\*.
- Ground task & receive capable from existing in theater handhelds.

- "Tablet" sized image downlinked within 90 minute revisit time.
- Capable to respond to ~10 users requests simultaneously.

*\*NIIRS defined by FAS*

### Air-launched int'l integration & logistics

"FedEx" packaging and storage for satellites

Launch integration "on-the-fly"

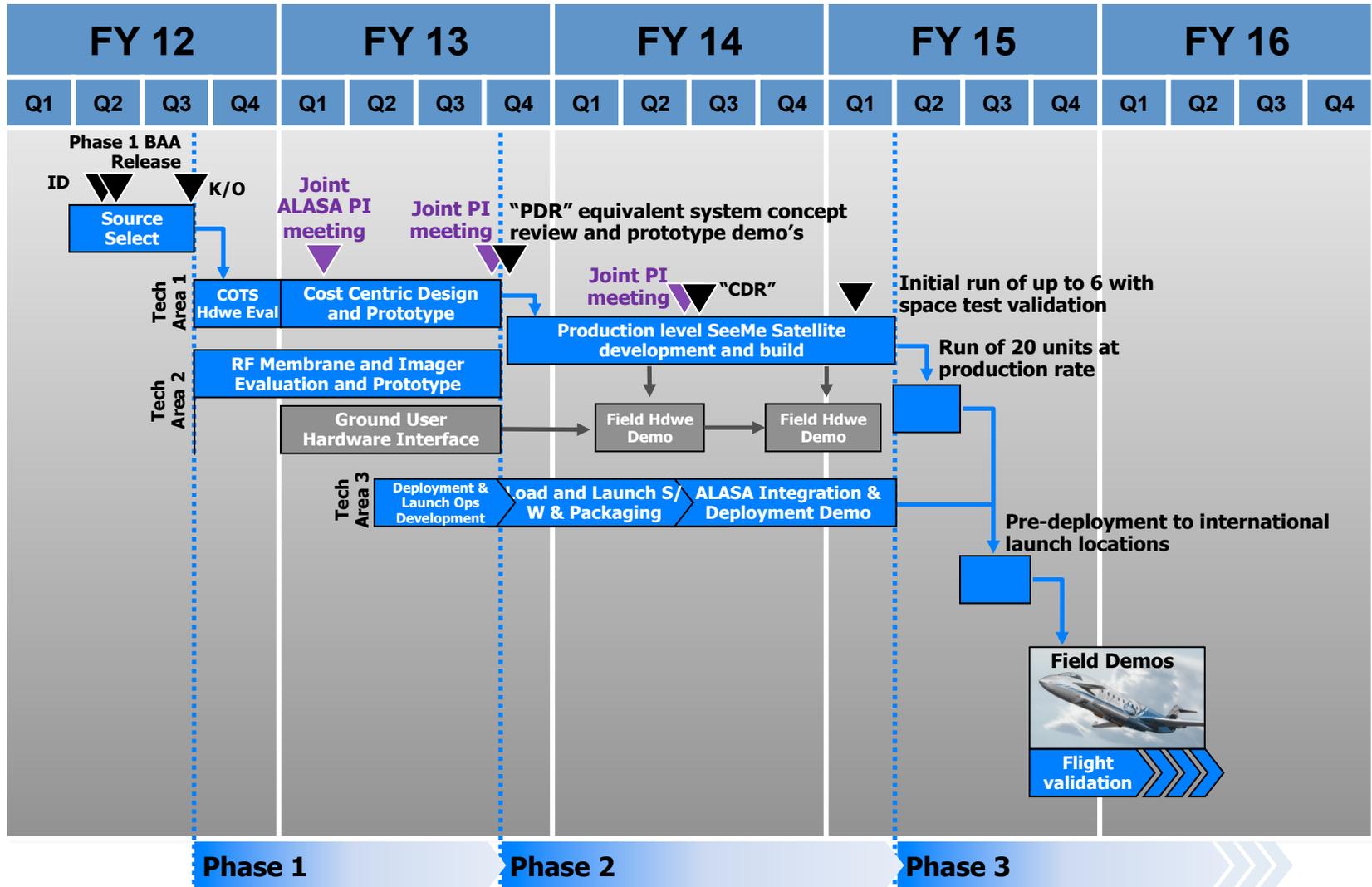
On-demand orbital planning and launch demonstration

- Shippable worldwide with COTS containers.
- Launch vehicle "plug" compatible.
- Minimum ground programming by any operator for load/launch.

- "Wooden round" storable onboard any military installation or commercial facility.
- Forward air base orbital optimization and load/launch programming capable.



# SeeMe Notional Program Plan





[www.darpa.mil](http://www.darpa.mil)