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RF Photonics – Key to Information Dominance

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The Future Domain

Surveillance & Recce:
- **Greater use of UAVs**
- **Greater use of Space**

Reduced Exposure

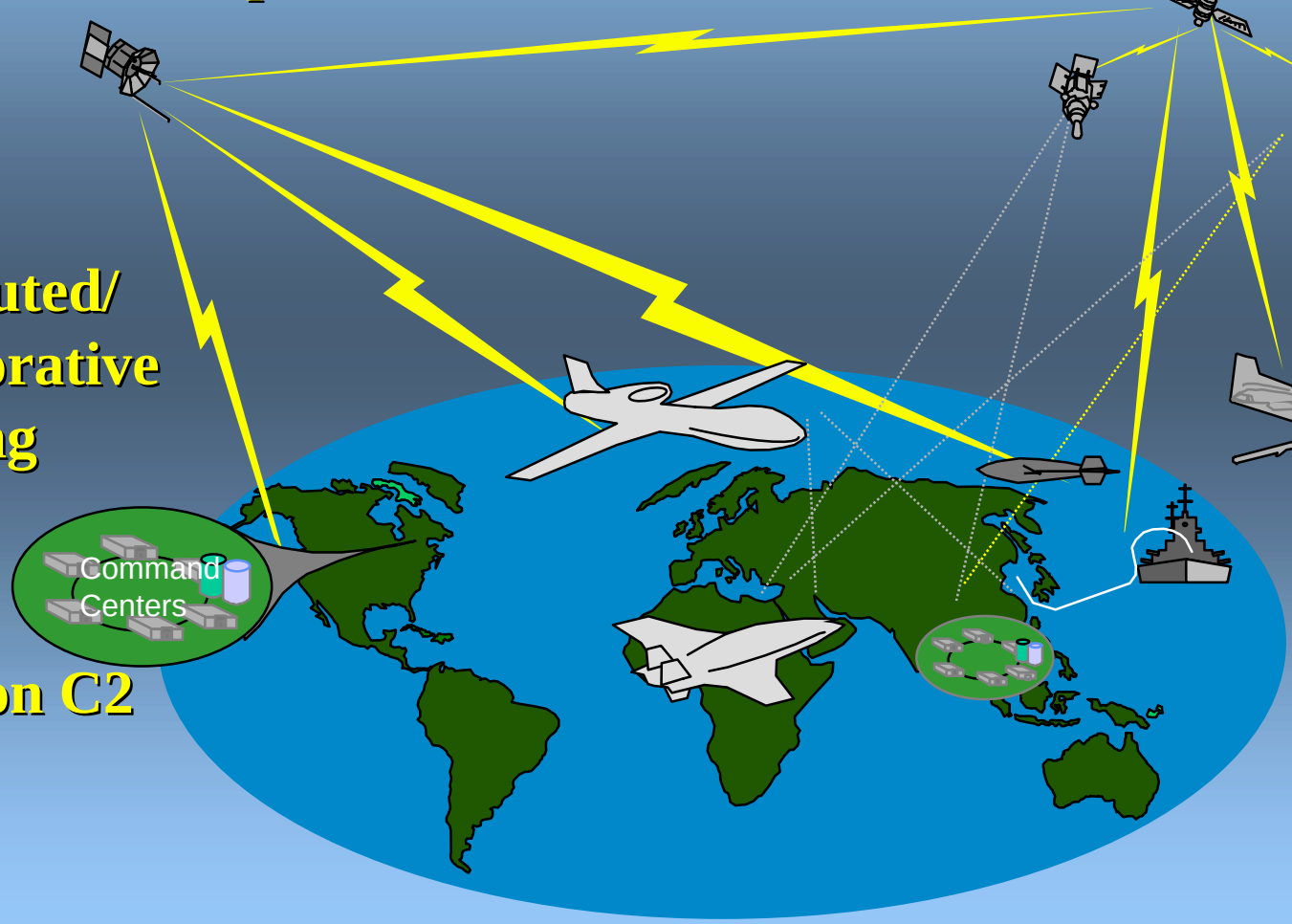
Reachback

Higher Capacity Links

Distributed/ Collaborative Planning

Smaller Footprint

Precision C2



Right Info to the Right Warfighter at the Right Time for the Right Decision!

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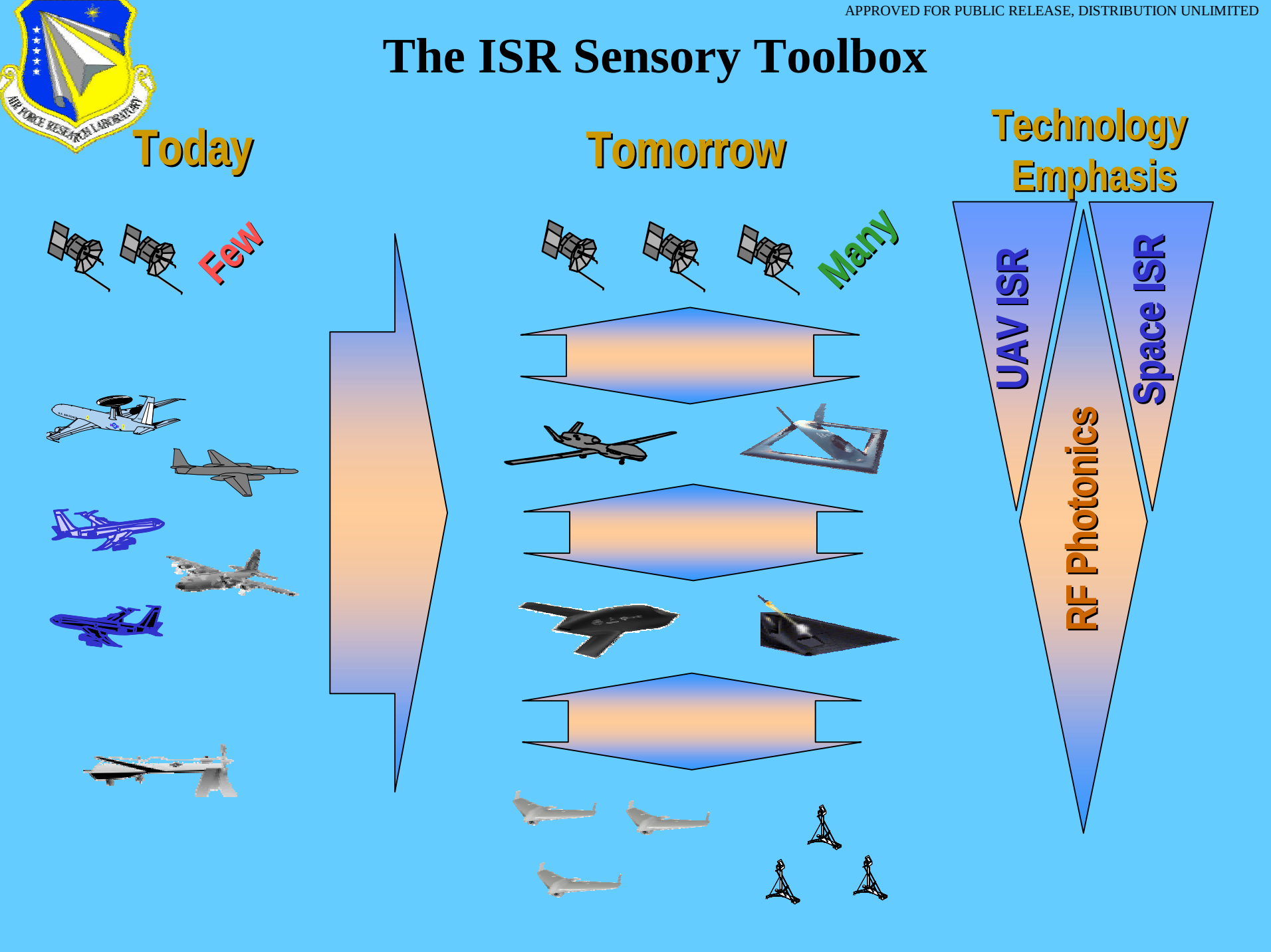
The ISR Sensory Toolbox



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Time Critical Targets

Iraqi SCUDS being inspected by UN Weapons Monitors.

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UAV Automation & Autonomy Trends

Relative Level of Autonomy

"Lightning Bug"

- Target Drone
- C-130 Launched
- Operator Controlled
- Limited Autopilot
- Photo Recce

"Predator"

- Autopilot
- Surveillance
- Dynamic Replanning

"Global Hawk"

- Autopilot
- T-O & Landing
- Racetrack
- Surveillance
- Route Replanning
- Long Endurance

"UCAV"

- T.O & Landing
- Navigation
- ESM Search
- Dynamic Replanning/ Retasking
- Weapons Release
- SEAD
- Multi-Vehicle Coordinated Flight

- Evasive Maneuvers
- Extreme Performance
- T.O & Landing
- Navigation
- Multi-ship Trajectories (TF/TA)
- Inter-Ship Collaboration
- Information Mining
- Sensor Control
- ATR
- Weapon Delivery
  - A/G & A/A
- BDA
- Manned A/C Augmentation
- In-flight Retargeting
- N on N Engagement

1960s 1980s 2000 2010 2015-20

Time

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RF SIGINT System Drivers

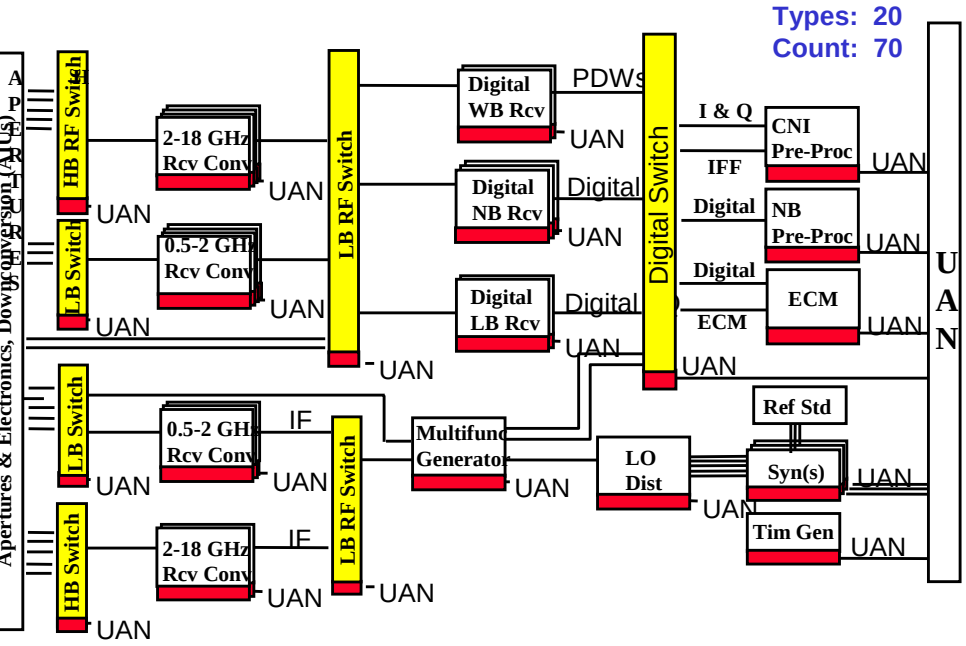
- **Reduction in Received Power Due to:**

  1) Power Management Techniques
  2) Spread Spectrum Techniques
  3) Use of Higher Frequencies

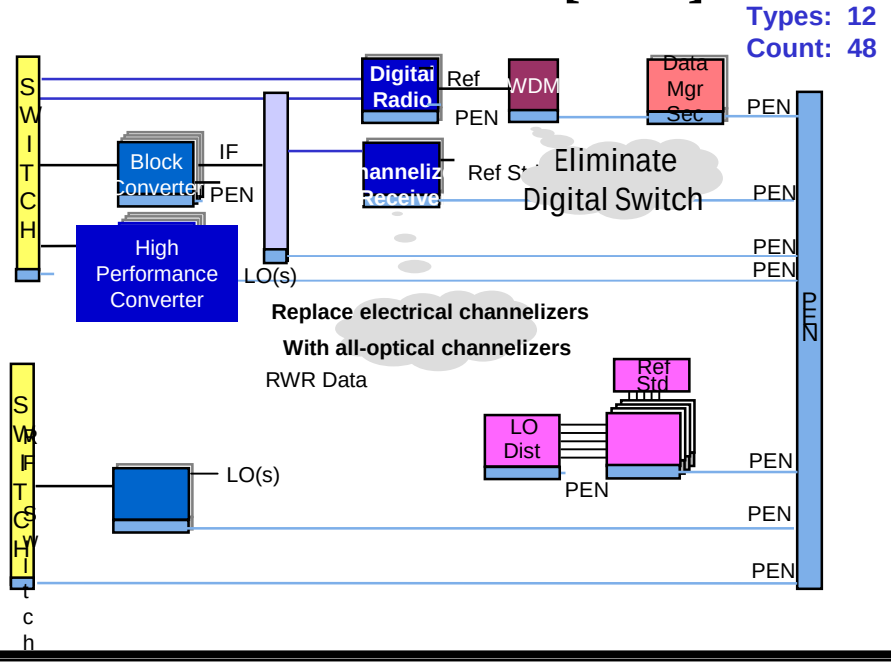
- **Several Choices Exist to Improve this Situation:**

  1) Get Closer to the Emitter
  2) Improve the Antenna Gain
  3) Use Coherent Processing Techniques

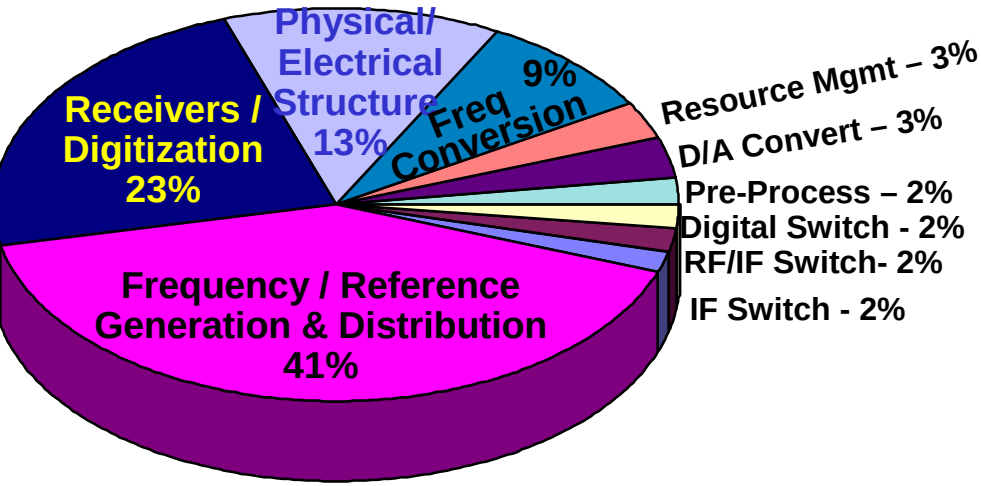
ISS Baseline Architecture



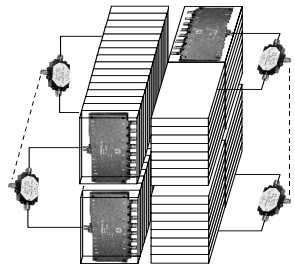
Future Architecture [2010]



ISS OSA Cost Breakdown



RF –vs- Photonic Switch Arrays
16 x 16 Interconnect



RF Module
PIN Diode Technology

Photonic Module
LiNbO3 Technology

400 cu. In	SIZE	15 cu. In
20 lbs	WEIGHT	1.5 lbs
130 W	POWER	13 W
0.5 – 18GHz	BANDWIDTH	> 40GHz
10-15 dB (RF)	INSERTION LOSS	8-12 dB (Opt)
70 dB (RF)	CHAN. ISOLATION	>75 dB (RF)
1 uS	SPEED	1 uS

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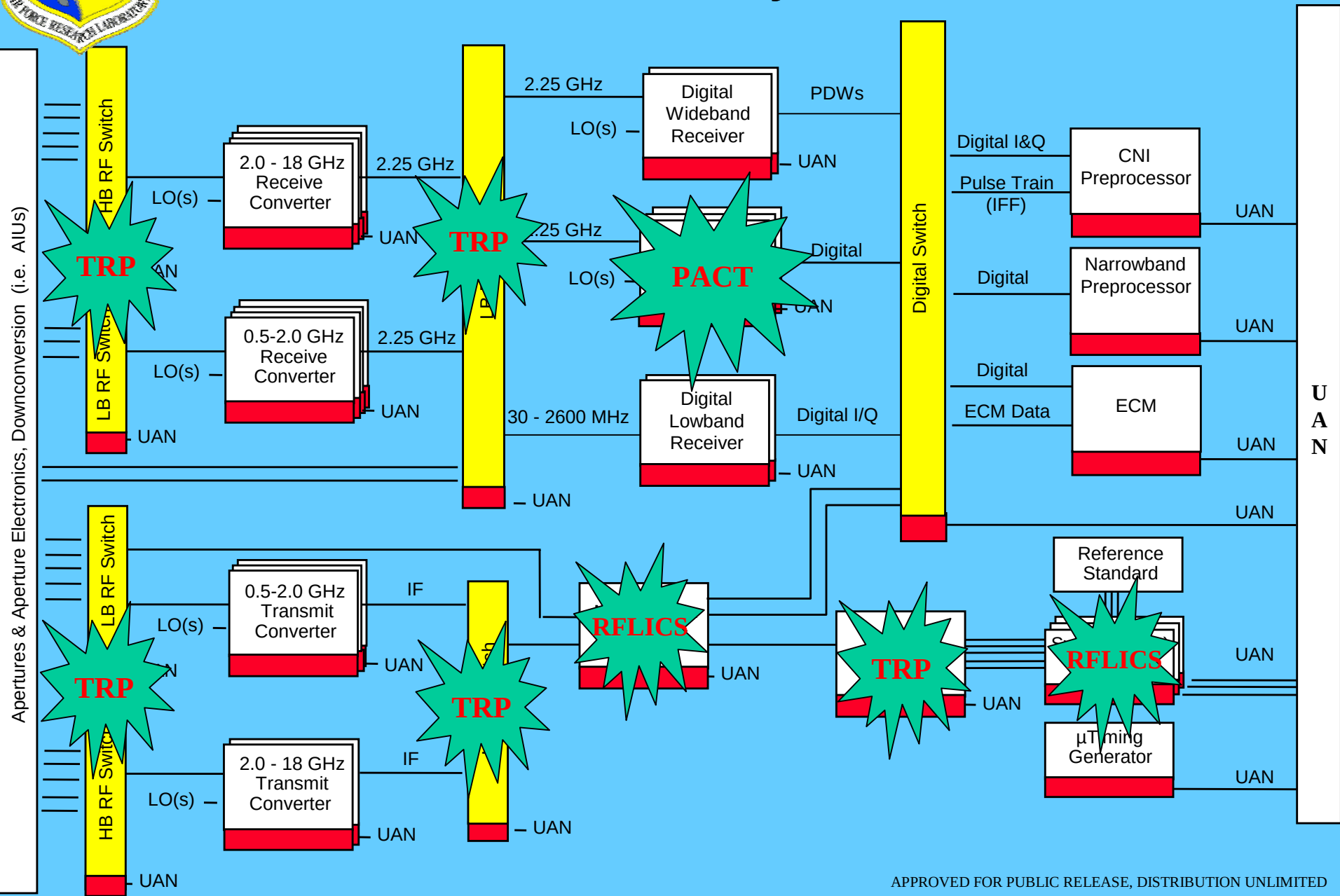
Remaining Investment Areas Within the RF System



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Payoff Area for RF Photonic Developments

- **Coherent Optical Processing**

  - Matched Filter Processing

  - Cross-Ambiguity Function (CAF) Processing

- **Filter Development**

- **Combining Existing Functional Components**