ISRAEL AEROSPACE INDUSTRIES

SYSTEMS MISSILES & SPACE GROUP

System Engineering Process Improvement using the CMMI in Large Space Programs

Sarit Assaraf, Revital Goldberg

Israel Aerospace Industries

10th Annual CMMI Conference *15-19 Nov. 2010 Denver CO.*

Israel Aerospace Industries (IAI)

- Largest industrial company in Israel
- Missiles, Satellites, UAVs, Avionics, Upgrades, RADARS, etc.
- Activities encompassing: Development, Production, Maintenance and Service of Aerospace Systems
- IAI divisions are certified for *ISO9000* and *AS9100*

IAI Organizational Chart

Military A/C Group (3 Div.)	Commercial A/C Group (4 Div.)	BEDEK Aviation Group (3 Div.)	Headquarters Organizations	Engineering Group (2 Div.)	Systems Missiles Space Group (5 Div.)	ELTA Systems Group Ltd. (4 Div.)

Process Improvement – WHY?

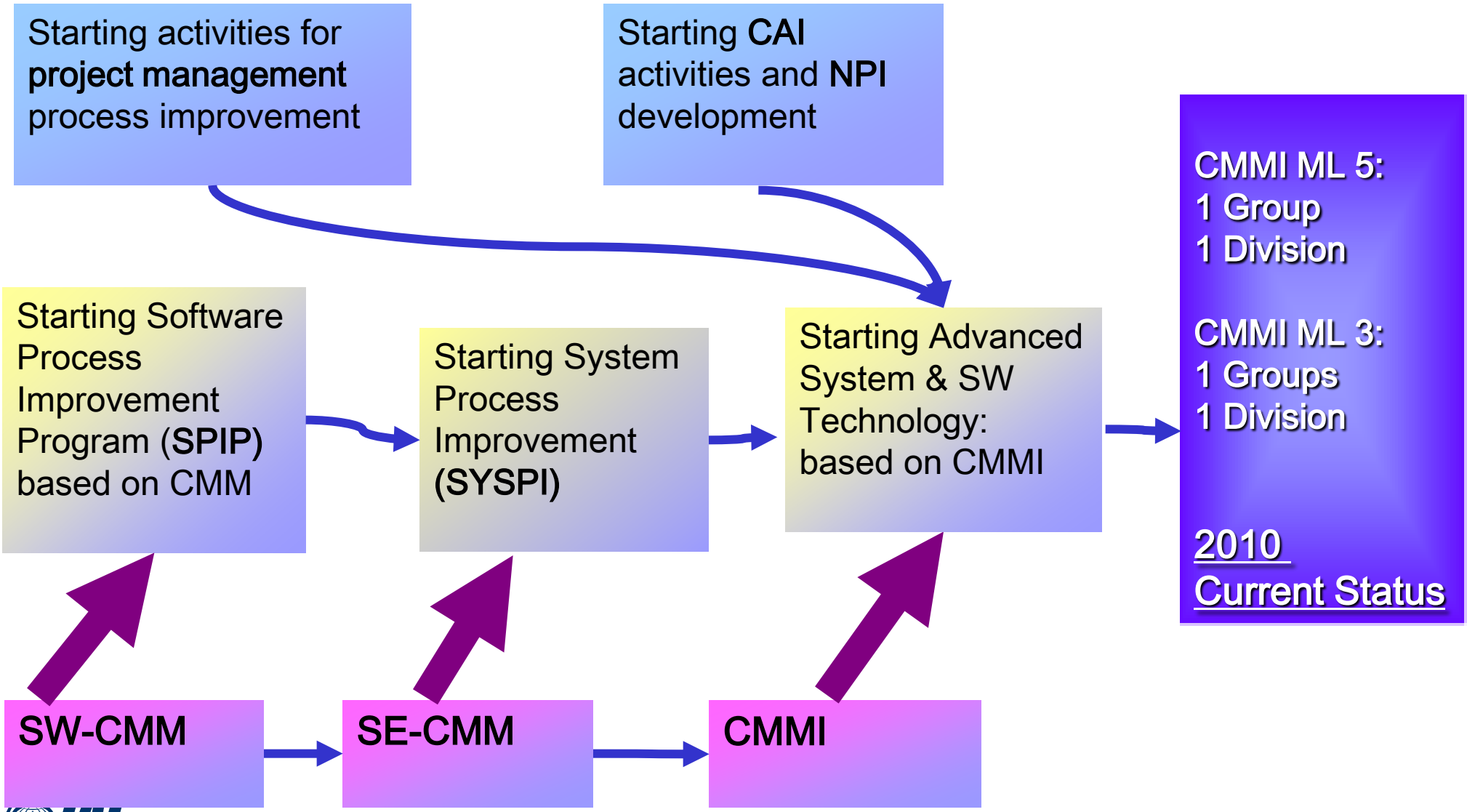
"The *Quality of a System* is Governed by the *Quality of the Process* Used to Develop it"

Watts Humphrey,

"Software Process Program" founder at the

Carnegie Mellon's Software Engineering Institute

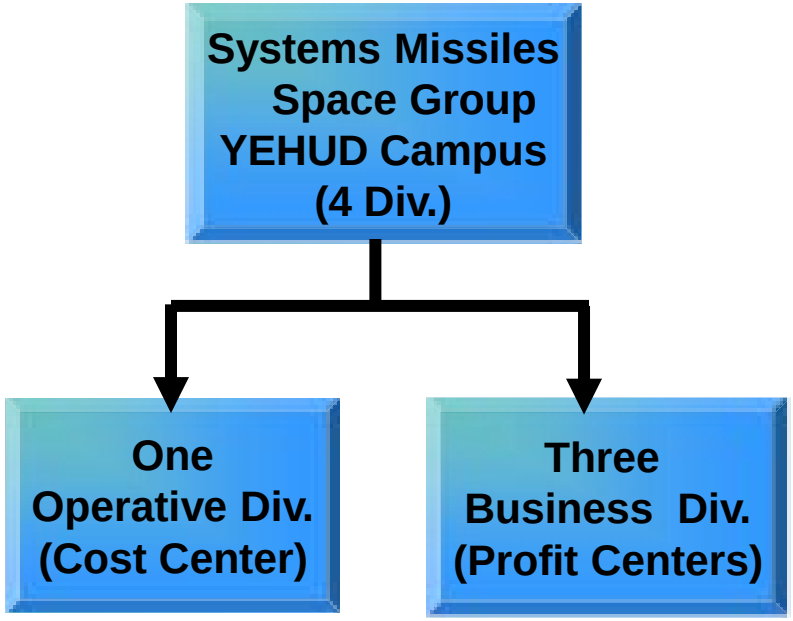
IAI Process Improvement Path



IAI Organizational Chart

Military A/C Group (3 Div.)	Commercial A/C Group (4 Div.)	BEDEK Aviation Group (3 Div.)	Headquarters Organizations	Engineering Group (2 Div.)	Systems Missiles Space Group (5 Div.)	ELTA Systems Group Ltd. (4 Div.)

CMMI & SEPG Program - Group Level (1)



- The CMMI implementation is ***managed as a program*** for process improvement at the group level

SAPIR – **S**tandard **A**nnual **P**rocess **I**mprovement **R**oadmap

- The ***management*** *concept* is based on the CMMI ORG and Support PAs

CMMI & SEPG Program - Group Level (2)

- Discipline based PITs - **P**rocess **I**mprovement **T**eams

  PM, SE, SW, HW, QA, CM, SAM, ORG

- **PIT members** = Process Leaders and Project Representatives
- Each PIT conducts meetings and activities, managed by PIT Leader
- **ORG PIT** comprises of all PITs Leaders
- **CMMI *Integrated plan*** consisting of all PITs' plans

IAI Process Improvement Strategy

IAI Corporate Level

IAI VP Operations
Engineering & Development
CMMI Program Office

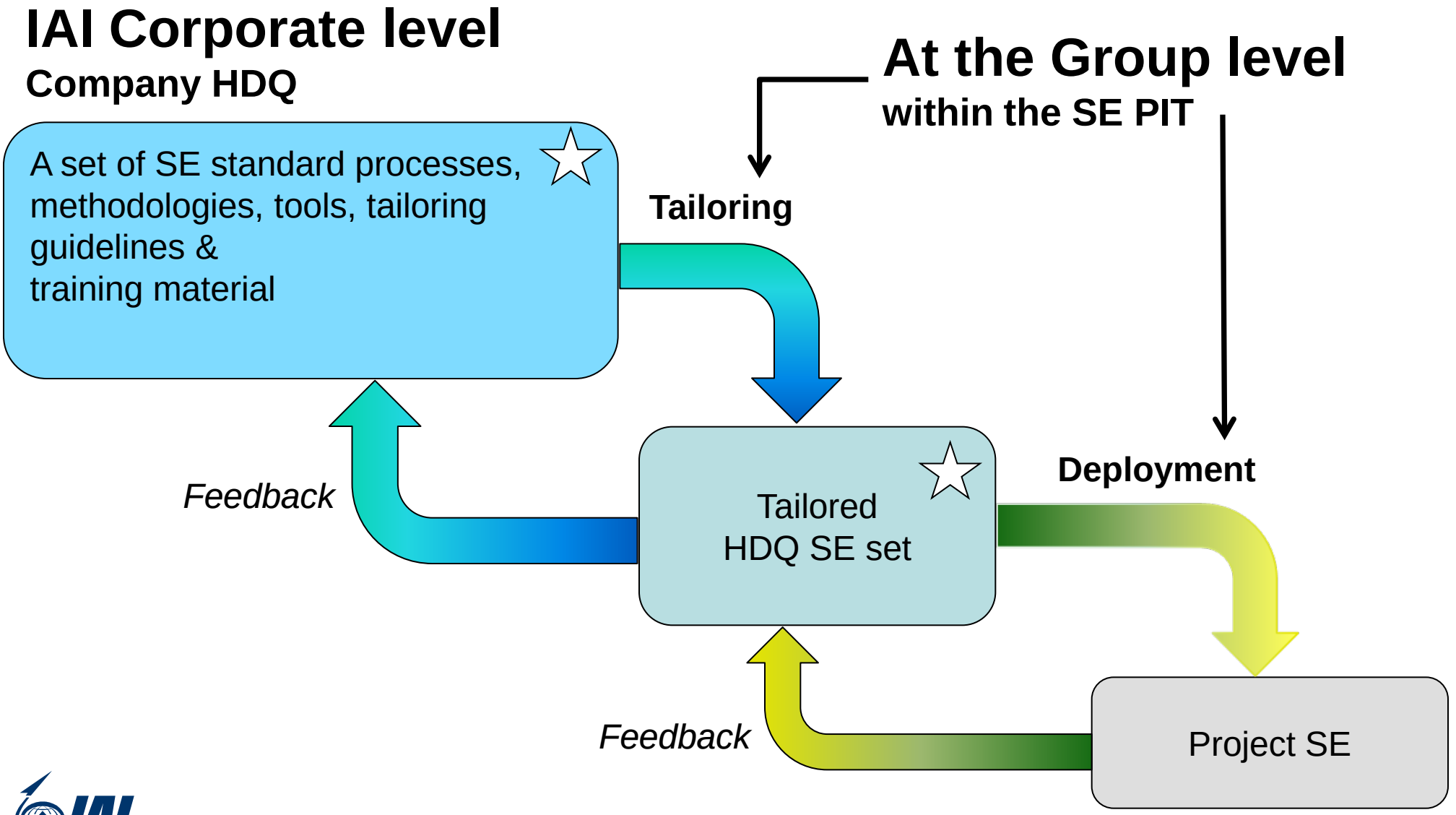
- Sponsorship
- Coordination
- Budget
- Process Assets Development

IAI Groups and Divisions

Process Improvement Activities

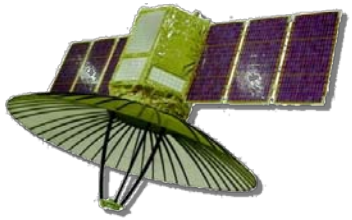
- Local Sponsorship
- Budget & Resources
- Process Assets Adaptation and Development
- Process Implementation
- Process Feedback

Process Definition and Tailoring Method

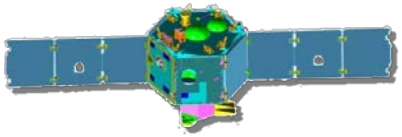


Space Systems

The Satellite Program = A System of Systems Program



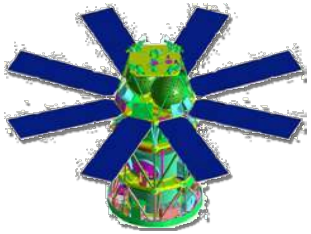
TECSAR
Synthetic Aperture
Radar



Venus

Observation satellites

OPTSAT 3000



EROS C

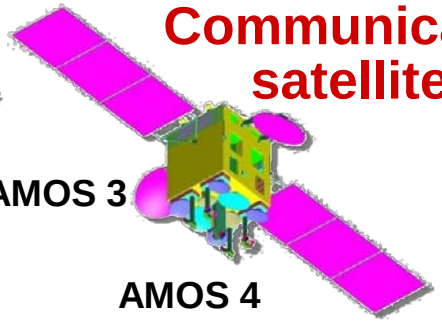
OFEQ

Shavit launch vehicles

Ground control stations

Communication satellites

AMOS 1,2

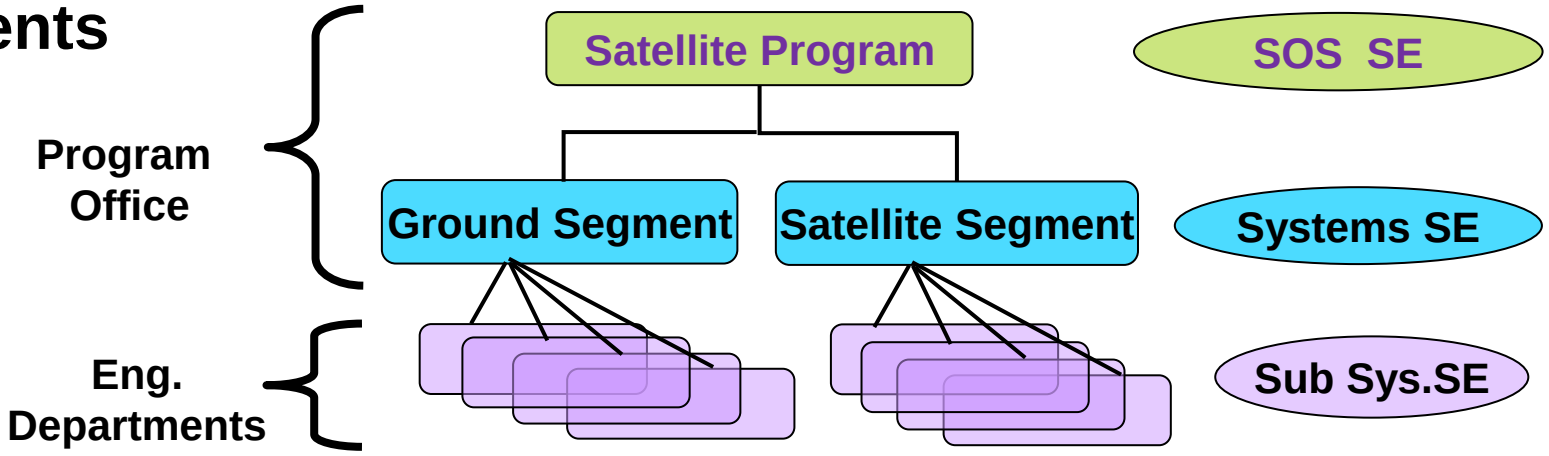


AMOS 3

AMOS 4
Advanced comm. Sat.

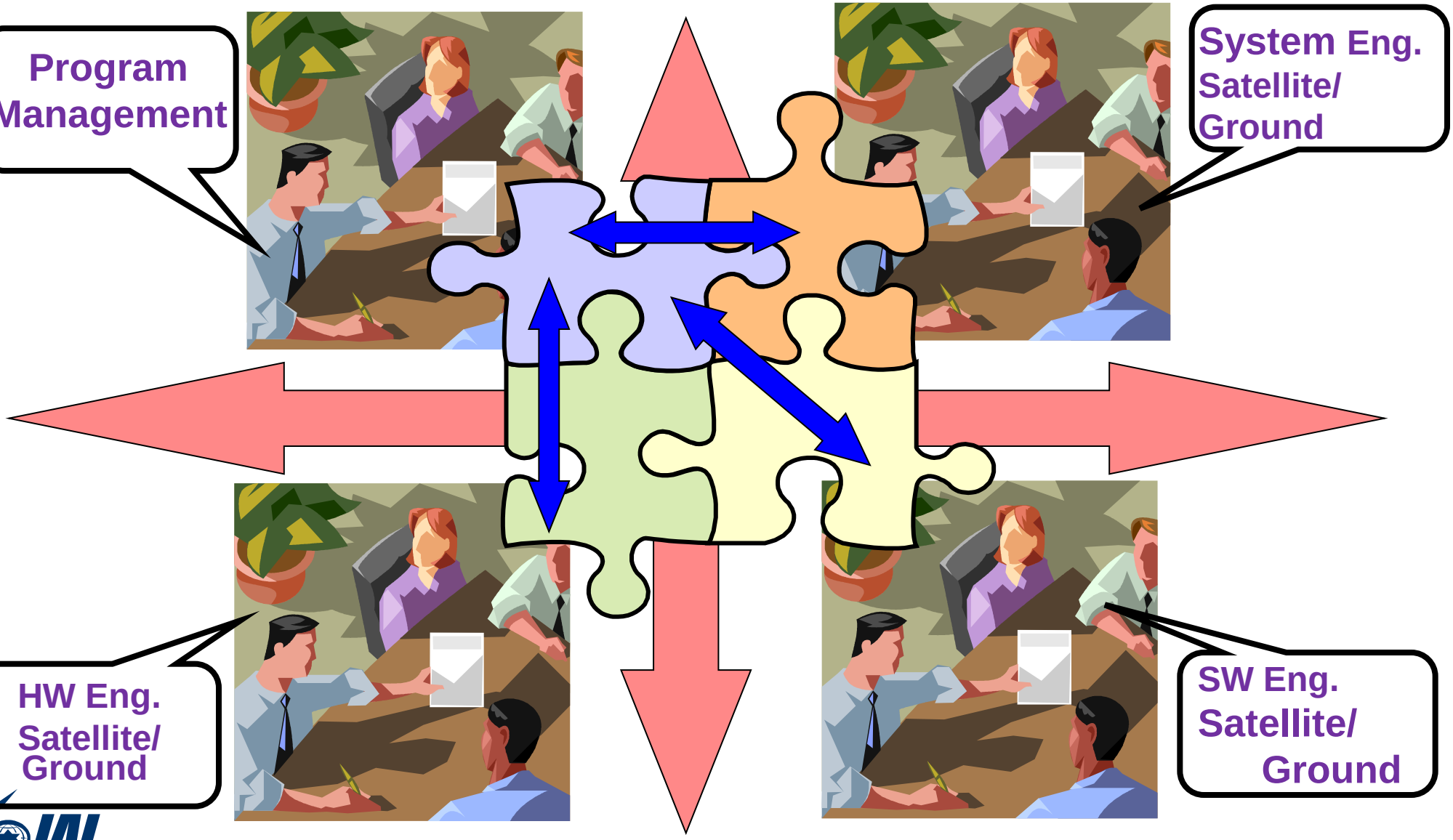
IAI SPACE Programs Main Characteristics
Program Internal Structure (1)

- **Decentralized SE at the group level –**
  The **SOS and the Systems SE are part of the program office**, also managing the Sub-Contractors.
- The **Sub Systems SE are part of the Engineering Departments**



- **Different views and meanings** of SE activities adequate to each level of the system: SOS, System, Subsystem.
- **Large project teams** (often, geographically dispersed)

IAI SPACE Programs Main Characteristics
Program Internal Structure (2)

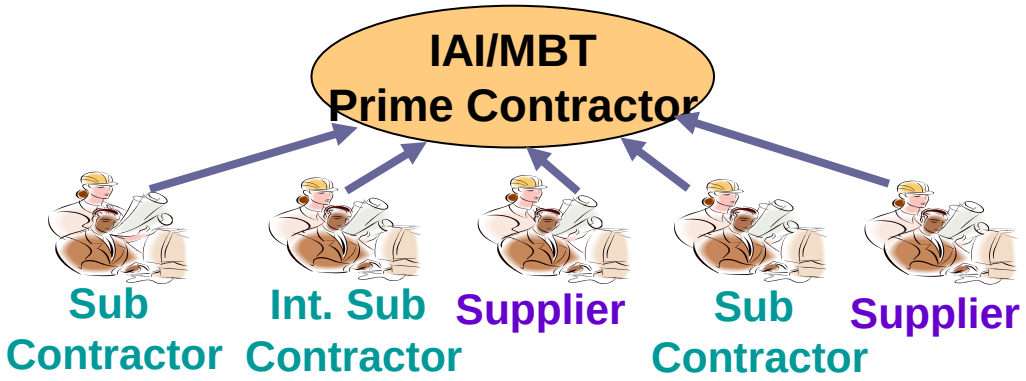


IAI SPACE Programs Main Characteristics
Program Internal Structure (3)

- **FORMAL *mutual commitment*** between the Program office
  and the Engineering Groups *supports implementation of*
  ***PP* SP3.3, *PMC* SP1.2, *REQM* SP1.2 & *IPM* SP2.2:**
  - The Program Office issues Internal Customer–Supplier Agreements
  - The Program Office allocates budget for the engineering groups against their commitment to supply adequate products on time
- The program establishes Integrated teams consisting of different disciplines (IPT = Integrated Product Teams)

IAI SPACE Programs Main Characteristics
Many Sub Contractors & Suppliers

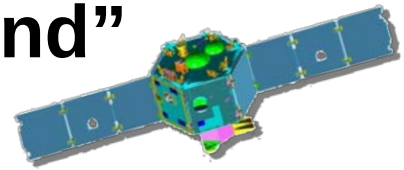
- **Complex coordination**
  - Internal (IAI) sub contractors
  - External sub contractors
  - Suppliers



Supports implementation of ***IPM SP2.1, SP1.5; SAM SPs; TS SP2.4; DAR***

- **Complex System Integration aspects** – Integration Strategy planning requires special attention **(*PI SP1.1*)**:
  - Scheduling
  - Sub Contractors Monitoring
  - Interfaces definition correctness and completeness ***(TS SP2.3, PI SP2.1)***
  - Integration Readiness Review ***(PI SP3.1)***

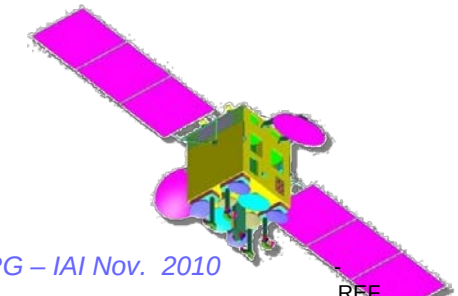
IAI SPACE Programs Main Characteristics
The Satellites "Nature"



- **Each Satellite is "One of a Kind"** however …
- **Verification & Validation are limited**, especially by the ability to simulate the environmental conditions.

Support implementation of ***VER & VAL SP1.1, SP1.2, SP1.3***

- **Once Launched –** Repair activities are limited to SW corrections and updates.
  Requires special attention to:
  - **Requirements validation** at early development stages ***(RD SP3.5)***
  - **Analysis of Failures** found on PI, VER & VAL stages ***(PI, VER SP3.2, VAL SP2.2)***



Conclusions & Lessons Learned

- The IAI process deployment method relies on a Corporate Level processes definition, followed by Group/Division Level tailoring and implementation.
- The products and projects characteristics require special attention to the ***RD***, ***PI***, ***VER*** & ***VAL*** process areas
- Using the internal Customer–Supplier Agreements and IPT's ensure
  - Better definition and management of the commitment
  - Integrated team work along the projects' life cycle

Thank you

Sarit Assaraf - *sassaraf@iai.co.il*

Revital Goldberg - *rgoldberg@iai.co.il*