

Diplomatic Clearance Solutions for the Integrated Flight Management System

SWANS 7- 8 Apr 05



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Problem Statement



- Air Mobility Command's (AMC) Diplomatic Clearance Problem
 - Loss of over \$80K in fuel and one sortie daily due to Dip clearance violation
 - Loss of over \$100K per day during contingencies
 - Indirect Effects:
 - Lost crew time
 - Delays in transportation/supply system
 - Disrupted flight/cargo movement schedules



Automated Clearance Tool (ACT)



ACT is an agent based, decision-support tool that supports the processing of diplomatic clearances at Air Mobility Command (AMC).



By leveraging the *Semantic Web* concept, ACT software agents utilize ontologies to reason about annotated data.



Solutions offered by ACT




Air Mobility Command plans global missions at a rate greater than 300 per day, many requiring a set of diplomatic clearances. Today mission planners must manually calculate lead times, calendar constraints, and country restrictions to determine diplomatic clearance viability.

Is there HAZMAT aboard?  *What type and category is it?* 

Is there enough lead time for a clearance? 

Which countries are you flying over?

What is the cargo? 

Who is aboard? 

Is this flight part of an accepted mission?

Can a Blanket Clearance be used?

What FIR Reporting Point can be used?



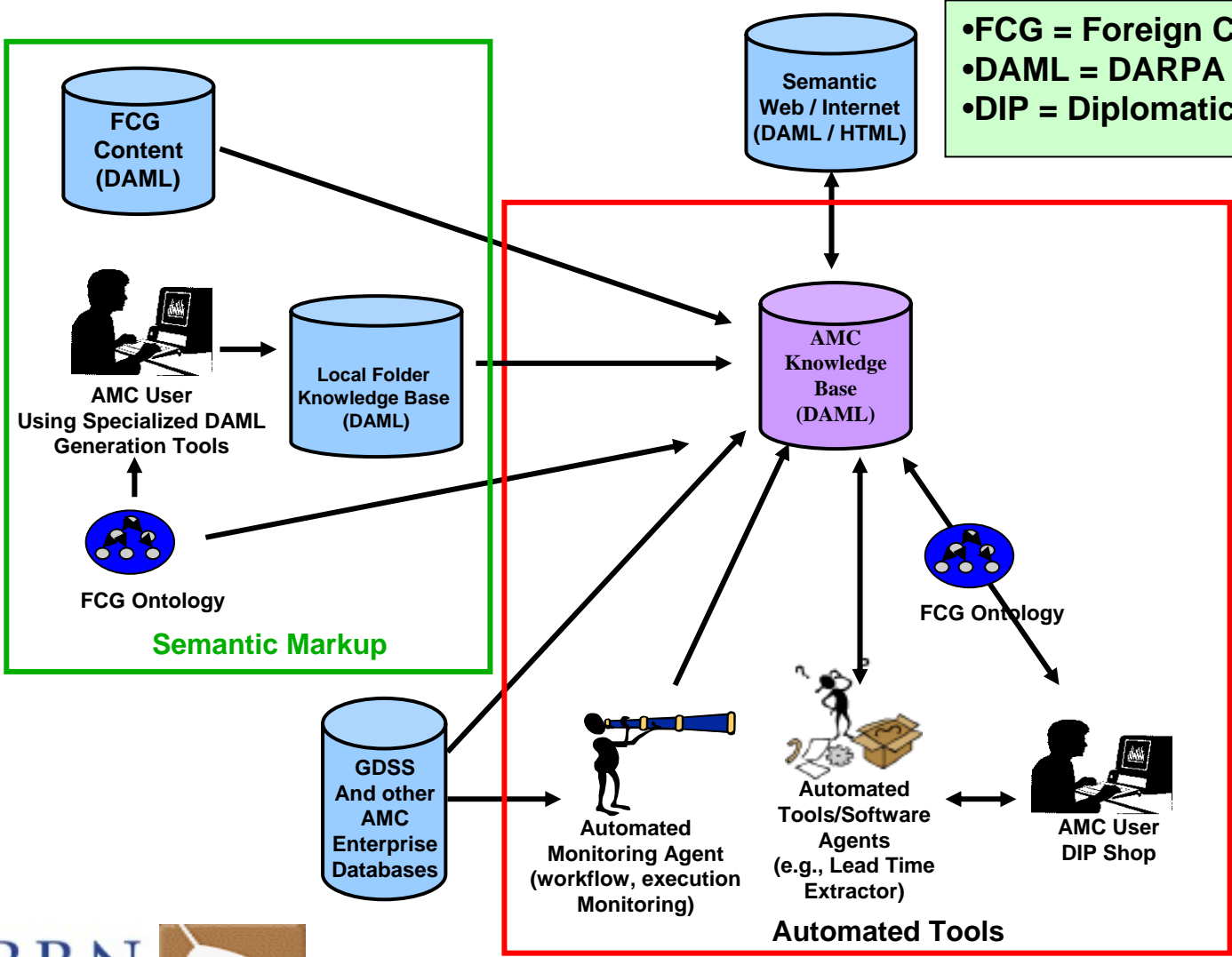
ACT automates much of this process, allowing the human planners to concentrate on the more difficult and timely problems.



FCG Automated Tool Development



- FCG = Foreign Clearance Guide
- DAML = DARPA Agent Markup Language
- DIP = Diplomatic Clearance Planner



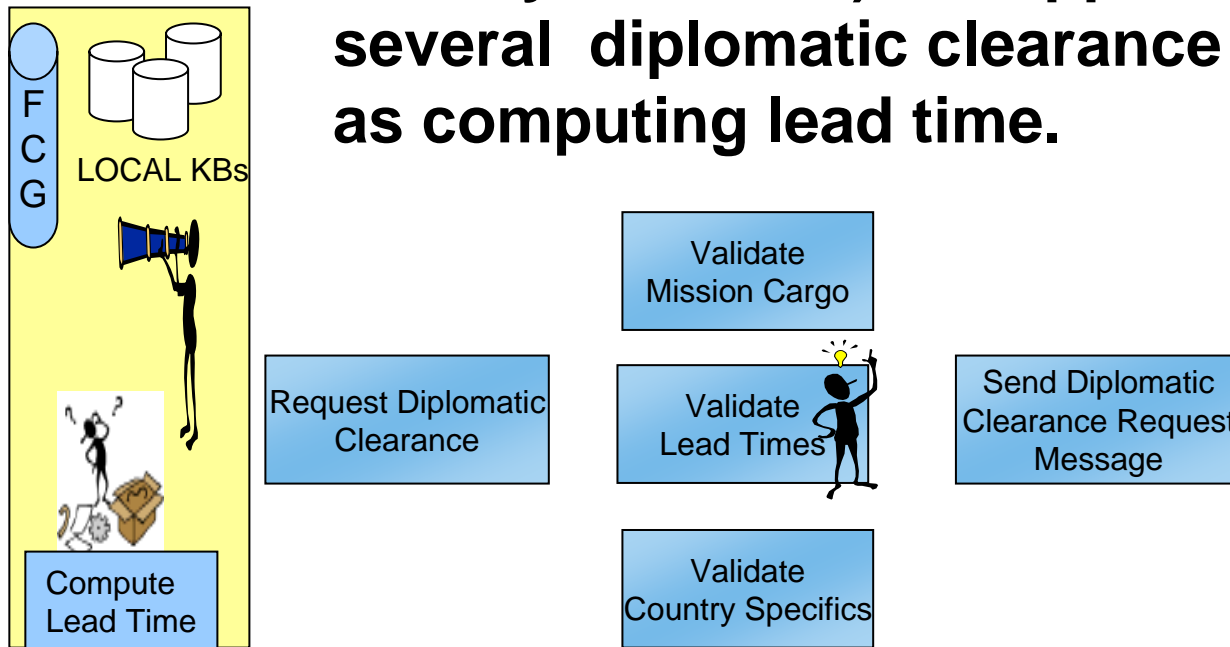
Carnegie Mellon



Use of Software Agent Technology



- ACT software agents will use annotated FCG country data and local knowledge bases (e.g., contact folder, working days, hazardous data, holiday data, etc.) to support and/or automate several diplomatic clearance functions such as computing lead time.





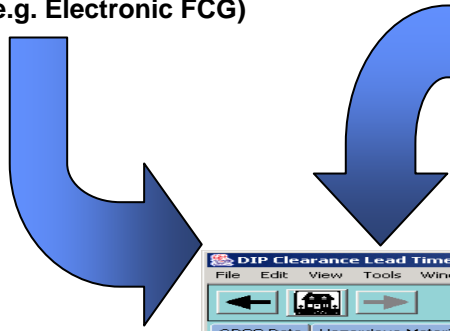
Automated Clearance Tool (ACT)



Semantically Annotated Brain Books



Authoritative Data Source
(e.g. Electronic FCG)



Hazardous Brainbook

Country	Requirements	Requirement	Lead Time	Lead Time	Remarks	Updated	Source
AFGHANISTAN	Overflights	2-3 - Poison	25	working days		2003-02-12	alice
ANTARCTICA	Overflights	1 - All Cases	10	working days		2003-03-26	
ARGENTINA	Landing	1 - All Cases	15	working days	failure to ob...	2002-09-29	FCG
ARJENTINA						0-26	FCG
FRANCE						0-12	alice
GERMANY						0-07	
ITALY						0-11	email
ITALY						0-20	alice
SPAIN							
TURKEY							
UNITED KING...							

Contact Folder

Country: SPAIN

Business: Business Fac

Business Fac: Business Fac

Event: Event

Contacts: US Embassy

After Duty Hours: After Duty Hours

Landing Lead Time City: A

Landing Lead Time UOM: working day

Cell Phone: Cell Phone

Commercial Phone: 11-34-91-50

Days of Operation: Apr, 17, 18 A

FAX: (34) 91-543-7

File As: File As

Hours of Operation: 0900-1700

Landing Validity: NETD minus

Office Symbol: Office Symbol

Overflight Validity: Overflight Validity

Overflight Lead Time City: A

Overflight Lead Time UOM: working day

POC: POC

SFINET: SFINET

Zulu Time: Zulu Time

Hazardous Requirements: prints of this

Country: UNITED KINGDOM

Business: Business Fac

Business Fac: Business Fac

Event: Event

Contacts: AmbEmbassy

After Duty Hours: 19 - contact AmbEmbassy operator and ask for DAO duty officer

Landing Lead Time City: TD

Landing Lead Time UOM: working days

Cell Phone: Cell Phone

Commercial Phone: F-499-9000, AIROPS (secret clearance/ser-icing) - 894-071

Days of Operation: NETD minus

FAX: Uncle FAX - 499-7688

File As: File As

Hours of Operation: 0900-1700

Landing Validity: must be during normal operating hours (0900-1800 hours loc...

Office Symbol: Office Symbol

Overflight Validity: Overflight Validity

Overflight Lead Time City: Overflight Lead Time City

Overflight Lead Time UOM: Overflight Lead Time UOM

POC: POC

SFINET: SFINET

Zulu Time: Zulu Time

Hazardous Requirements: prints of this

Lead Time Calculator

Map showing a globe with a red circle around the United Kingdom. Text overlay: **RED shading indicates a Lead Time problem**

ER22

Lead Time Calculator

Cargo Lead Time

DIP Clearance Lead Time Tool

File Edit View Tools Windows Help

GDSS Data | Hazardous Materials | TACC Form | Lead Time | D

Mission Start Date: 26 Sep 2003 (271)

ICAO	Country	Lead Time
KPSM	UNITED STATES	
CYQX	CANADA	Sep 18, 2003
EINN	IRELAND	Sep 25, 2003
ETAR	GERMANY	Sep 22, 2003
LENG	SPAIN	Sep 23, 2003
LFMI	FRANCE	Sep 17, 2003
ETNG	GERMANY	Sep 22, 2003
EGUN	GERMANY	Sep 22, 2003
BIKF	UNITED KINGDOM	Sep 15, 2003
	ICELAND	Sep 26, 2003
	ANTARCTICA	Aug 23, 2003
CYQX	CANADA	Sep 18, 2003
KPSM	UNITED STATES	
KADW	UNITED STATES	

Insert Country | Delete Country

Hazardous Cargo | Compute | Create New Hazardous Cargo Form

Earliest Lead Time: Aug 23, 2003
Short Notice: YES Short notice approval required.

September 18, 2003

Create Form | Load Saved Form | View Map | Auto Fill

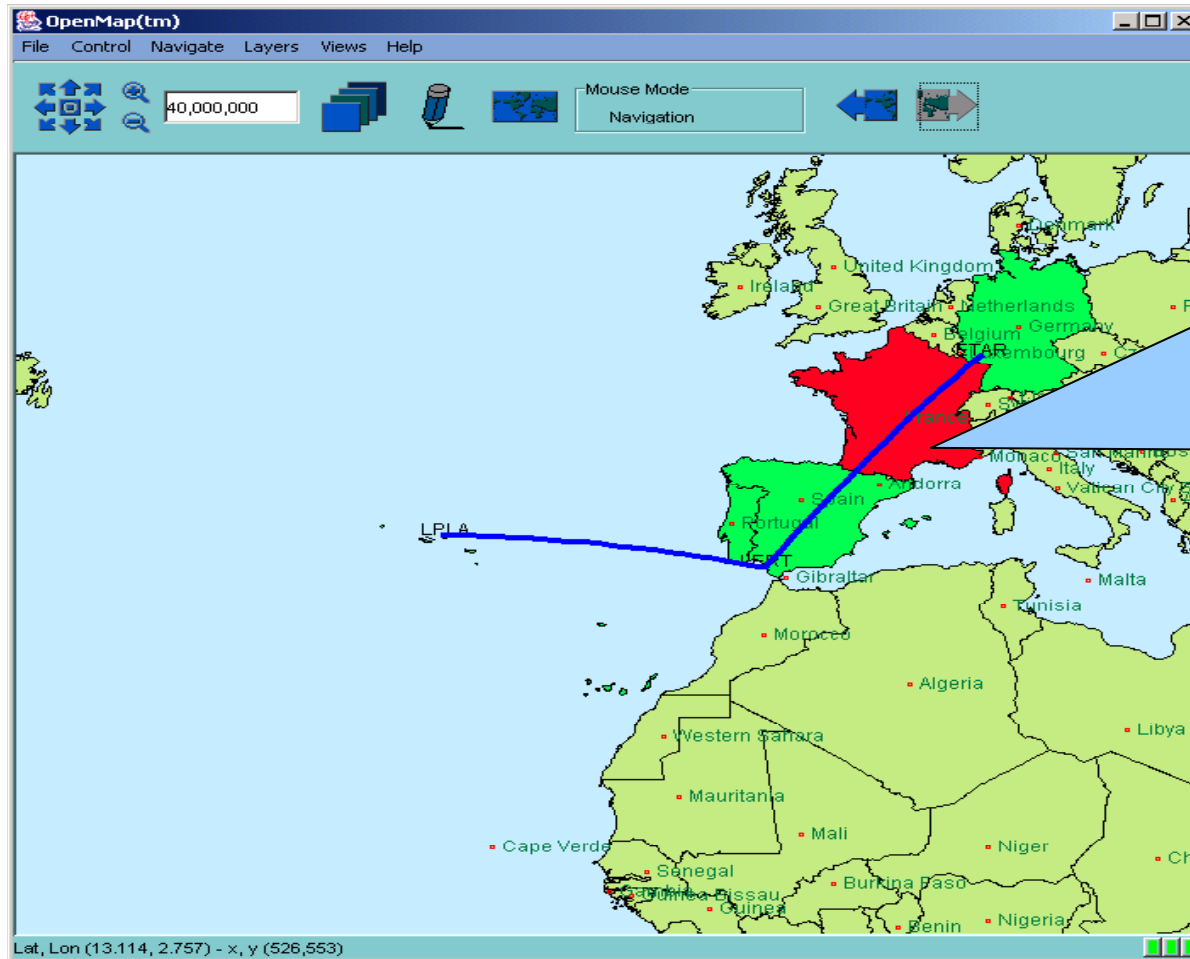
Loading Forms

- Loaded Forms --> Loaded
- GDSS Data --> Loaded
- HazMat --> Loaded
- TACC Form --> Loaded
- Lead Time --> Loaded
- DIP Clearance Form --> Loaded

Lead Time Compute Agent



Using Act to Support Diplomatic Clearance Processing



Restriction identified by ACT software agent using rules derived from the semantically annotated FCG Country data and local knowledge bases (e.g., working days, holidays, hazardous cargo, contact folder)



Using Blanket Clearances



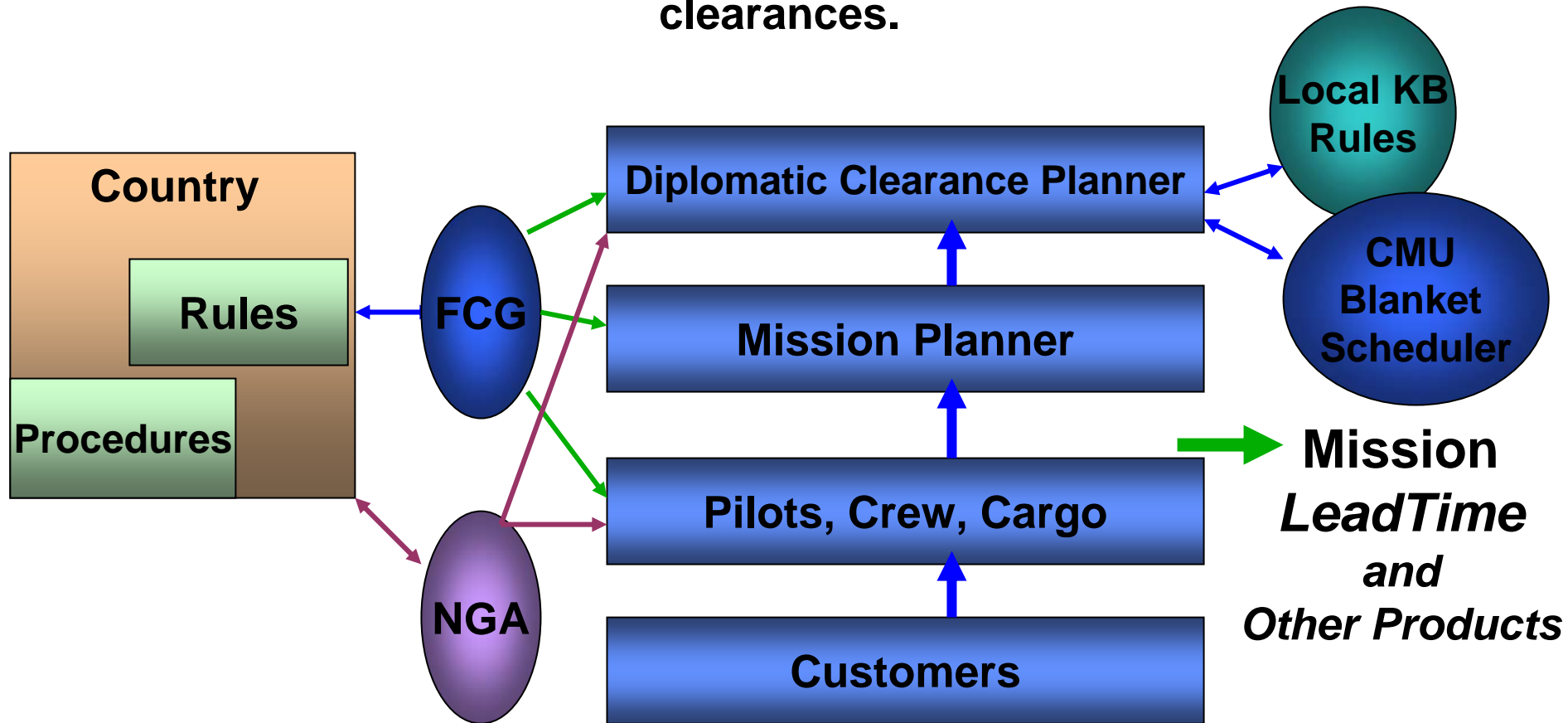
- **When a Blanket Clearance can be used for a landing or overflight, ACT automatically re-computes the lead time for the affected legs and overall mission.**
- **The CMU tool manages the assignment of blankets by checking that all of the conditions for usage of a blanket are valid before granting the blanket. The system can also detect conflicts. Future work would allow this tool to support de-confliction and re-assignment of blankets as needed. It could also support blanket management, e.g., request for new blankets when blanket clearances expire.**



Lead Time Engine that Reasons with Semantically Annotated Data



- Allow planners at different levels of the C2 structure to reason about the requirements of an AMC mission for diplomatic clearances.





The Technology Behind ACT



- **ACT uses an agent-based framework and OWL technology for:**
 - Processing diplomatic clearance mission requests
 - *Monitoring key events* in the process
 - Making *changes* to existing plans as needed
 - Making requests for *blanket allocation* and *management* easier
- **ACT uses Ontologies and Semantic Annotation to provide the following capabilities:**
 - *Data-form consistency* and update
 - *Alerts* to the user about environment changes (e.g., new missions, data changes)
 - *Graphical methods* to display mission and/or diplomatic clearance problems.
 - The Automatic generation of *explanations* of how calculations are performed.



How ACT Utilities Benefit the AMC Operator



- **Fast and accurate Lead time computation**
- **Lead time changes automatically when blankets are used**
- **Lead time recalculation when missions change**
- **CMU Blanket Scheduler can automatically allocate & de-allocate blankets when a mission changes**
- **Automatic methods for reasoning with hazardous data**
- **Methods for setting the FIR reporting point**



Improvements On Current Operations and Processes



- **Increased Automation**
 - Data Entry
 - Lead time computation
 - Constraint checking
 - Blanket Allocation/De-Allocation
 - Reasoning with Semantic Markup
- Tools that support the creation of annotated data (e.g. contact folder, holidays, working days)
- Ability to communicate in a loosely coupled fashion with other services (e.g. CMU Blanket Scheduler)
- Ability to utilize multiple annotated data sources (e.g. NGA and FCG)