Information Collection in Forest Fire Response Operations; A Foundation for Situation Awareness

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Situation Awareness in the Response process

Complex Dynamic Situation → Information Collection (System Updates) → Information Processing → Response Decisions → Response Actions

Level 1 SA (Perception) → Level 2 & 3 SA (Understanding and Projection)

Continuous Development → Continuous Updates
Technology & Communication

CFCEE

National

Provincial:
- Duty Officer
- Intelligence Officer

Regional:
- Duty Officer
- Intelligence Officer
- Aircrafts Management Officer
- Detection Officer
- Radio Operator

Sector:
- Sector Response Officer
- Radio Operator

Crew:
- Incident Commander
- Crew Leader
- Crew Members
- Pilots
- Air Attack Officers

provincial crew requests

update FMIS & bulletin board

weather briefing

project fires

active fire updates

resource information

weather info + fire weather
AFFES Mapper

aircraft dispatch

SOP

crew dispatch

crew alerts & TIP

DFOSS update

add specific task assignments

crew requests

fire reports

radio communication

documented in Fire Diary
Research Methodology

Pre-design Study
- Users’ and Process Requirements analysis
- Enhancement proposals

First Design Iteration
- Analysis verification Proposal evaluation
- Office and Mobile Interface Design

Second Design Iteration
- Preliminary Design Evaluation
- Prototype Design

Third Design Iteration
- User Evaluation
- Final Design Development

Office visit: Observations Interviews
Phone interviews & questionnaire
GOMS model evaluation
Cognitive walkthrough, usability evaluation & questionnaire
Methodology

- Office Visits
- Observations
- Interviews
- Training simulation

Ministry of Natural Resources & Forestry
Scope of Results
Information Categories

Information Input
- Forecasts, resources availabilities and statues

Task & Decisions
- Role based preparedness and response decisions

Overall Situation Awareness
- Information on shared display of Real time maps, alerts and fires updates
The Information Collection Process

Reliance on Verbal and Radio Communication

- **Facilitate Information Collection**
- Facilitate Team Situation Awareness and Communication
The Design Proposal
Information requirements analysis

Preparedness measures
- Communicate alert levels to crew leaders and update system and regional office

Regional SOP and weather forecast phase recommendation
- Crew and resource availability

Initial fire report
- Process report
  - Pinning important info
- Response decision
- Crew dispatch
  - IC updates and requests
  - Estimated commitment times

Monitoring fire reports
- Prediction of resource needs and plans

Fire prioritization
- Evaluation of resource availability, area risk and situation development projection

Dispatch of additional resources (crews, engines, helicopters)
- Evaluation of needs and capacities

Communicate action plans and aircraft requests to regional office for approval
- Resource availability and locations
- Sector risk areas, weather and values maps
- Alerts and availability
- Fire lists and sector risk areas and weather
User Evaluation
The Office Interface

<table>
<thead>
<tr>
<th>Fire #</th>
<th>Sector</th>
<th>Firetype</th>
<th>Initial Report #</th>
<th>Radio Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>IC</td>
<td>Resources</td>
<td>Values</td>
<td>Lightning</td>
<td>Topography</td>
</tr>
</tbody>
</table>

**Resources**

<table>
<thead>
<tr>
<th>type</th>
<th>#ID</th>
<th>status</th>
<th>getaway</th>
<th>arrival</th>
<th>attack</th>
</tr>
</thead>
<tbody>
<tr>
<td>crew T1</td>
<td>Douglas</td>
<td>on fire</td>
<td>16:40 - 06/07</td>
<td>16:56 - 06/07</td>
<td>17:20 - 06/07</td>
</tr>
<tr>
<td>helicopter</td>
<td>H-03</td>
<td>on fire</td>
<td>16:40 - 06/07</td>
<td>16:56 - 06/07</td>
<td>17:20 - 06/07</td>
</tr>
<tr>
<td>Tanker</td>
<td>T-205</td>
<td>enroute</td>
<td>17:30 - 06/07</td>
<td></td>
<td></td>
</tr>
<tr>
<td>crew T2</td>
<td>Jackson</td>
<td>dispatched</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Topography**

- Trapper's cabin
- North Bay
- Temiskaming Shores
- Elliot Lake
- Greater Sudbury

**Values**

- Status: NUC
- Intensity class: N5
- Smoke: Foul
- Fuel:

**Legend**

- Threatened value
- Total value around fire

**Fire Severity**

- Cabin: 50 m, direction W, status Threat, saved
- Cutwood: 30 m, direction S, status saved

**Weather Briefing**

- full
- sector: W03
- IC: lastname,first

**Buttons**

- save changes
- generate fire report
# Information Categories

<table>
<thead>
<tr>
<th>Logistics</th>
<th>Initial Report</th>
<th>Fire Reports</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>General</strong></td>
<td><strong>Location</strong></td>
<td><strong>Fire</strong></td>
</tr>
<tr>
<td>Confirmation Information</td>
<td>Degrees</td>
<td>Behavior</td>
</tr>
<tr>
<td>Aircraft Information</td>
<td>Response Sector</td>
<td>Values</td>
</tr>
<tr>
<td><strong>Resources</strong></td>
<td><strong>Response</strong></td>
<td><strong>Area</strong></td>
</tr>
<tr>
<td>Aircraft Information</td>
<td>Response Sector</td>
<td><strong>Weather</strong></td>
</tr>
<tr>
<td>Crew Information</td>
<td>Base Map</td>
<td><strong>Fire</strong></td>
</tr>
<tr>
<td><strong>Location</strong></td>
<td><strong>Fire Priority</strong></td>
<td><strong>Size</strong></td>
</tr>
<tr>
<td><strong>Response</strong></td>
<td>Zone</td>
<td><strong>FBP Fuel Type</strong></td>
</tr>
<tr>
<td><strong>Fire Priority</strong></td>
<td><strong>Response Objective</strong></td>
<td><strong>Behavior</strong></td>
</tr>
<tr>
<td><strong>Zone</strong></td>
<td><strong>Time Objectives</strong></td>
<td><strong>Values</strong></td>
</tr>
<tr>
<td><strong>Response Objective</strong></td>
<td><strong>Concerns</strong></td>
<td><strong>Intensity</strong></td>
</tr>
<tr>
<td><strong>Time Objectives</strong></td>
<td><strong>Spreading</strong></td>
<td><strong>Spread</strong></td>
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<tr>
<td><strong>Concerns</strong></td>
<td><strong>FM Zone</strong></td>
<td><strong>Sky Condition</strong></td>
</tr>
<tr>
<td><strong>Spreading</strong></td>
<td><strong>Fire Type</strong></td>
<td><strong>Wind Speed</strong></td>
</tr>
<tr>
<td><strong>FM Zone</strong></td>
<td><strong>Radio Frequency</strong></td>
<td><strong>Sky Condition</strong></td>
</tr>
<tr>
<td><strong>Radio Frequency</strong></td>
<td><strong>Fire Type</strong></td>
<td><strong>Condition/Status</strong></td>
</tr>
<tr>
<td><strong>Fire Type</strong></td>
<td><strong>Resource Requirements</strong></td>
<td><strong>Topography</strong></td>
</tr>
<tr>
<td><strong>Resource Requirements</strong></td>
<td><strong>Zone</strong></td>
<td><strong>Wind Direction</strong></td>
</tr>
<tr>
<td><strong>Zone</strong></td>
<td><strong>Fire Type</strong></td>
<td><strong>Wind Speed</strong></td>
</tr>
<tr>
<td><strong>Fire Type</strong></td>
<td><strong>Resource Requirements</strong></td>
<td><strong>Sky Condition</strong></td>
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**1 - HIGH**

- Confirmation Information
- Aircraft Information
- Degrees
- Response Sector
- Behavior
- Values
- Size
- FBP Fuel Type
- Wind Direction
- Wind Speed
- Sky Condition

**2 - MEDIUM**

- Radio Frequency
- Crew Information
- Base Map
- Fire Priority
- Zone
- Response Objective
- Time Objectives
- Concerns
- Spreading
- FM Zone
- Fire Type
- Resource Requirements
- Zone
- Fire Type
- Resource Requirements
- Zone
- Fire Type
- Resource Requirements
- Zone
- Fire Type
- Resource Requirements
- Zone

**3 - LOWEST**

- Fire Number
- Equipment Information
- Fire Type
- Resource Requirements
- Zone
- Fire Type
- Resource Requirements
- Zone
- Fire Type
- Resource Requirements
- Zone

- Year
- Initial Report Number
- Operator ID
- Subdivision
- Air attack requirement
- Depths of burn
- Railway (+milage)
- Smoke
- Flame
- Spotting
The Mobile Interface
Evaluation Outcome

- **Level 1 SA (perception)**
  - Information Collection (system updates)
  - Efficient and effective data input

- **Level 2 SA (understanding)**
  - Communication and distribution of information through the interface

- **Level 3 SA (projection)**
  - Efficient and effective visualization

Proposed system advantages
Future Research

• Connectivity of remote teams
• Decision support